Design News

A CAHNERS PUBLICATION

AUGUST 4, 1961

What synthetic sealing materials should I use—and when

Environmental conditions generally dictate the type of synthetic rubber for a specific oil sealing application.

Where temperature, shaft speed, runout, eccentricity, and lubricant type are "normal", standard Buna N synthetic rubber compounds are satisfactory. If, however, the application is "dry running", a compound must be selected that will operate satisfactorily with a very small amount of lubricant. If the application involves excessive abrasion, highly "loaded" compound stocks should be provided. At temperatures over 250° F polyacrylics or silicone compounds are indicated; if high temperature is accompanied by a solvent base or additive lubricant, polyacrylics are definitely preferred.

Thus many variables govern successful oil sealing. The chart below gives more data; for complete information from the world's foremost oil seal laboratories, call your National Seal engineer. He's in the Yellow Pages, under Oil Seals or O-Rings.

SYNTHETIC RUBBER COMPOUNDS — **RECOMMENDED APPLICATIONS**

Comp. No.	Base Polymer	Min/Max Operating Temperature	Life Index	Price Index	Automatic Transmissions	Pinions	Axle Seals	Engine Seals	Misc. Applications
B-63	Buna N	—40°F/225°F	100	100				Excellent for small gas engines.	Excellent for small non-spring loaded seals.
B-86	Buna N	—30°F/225°F	100	100		Satisfactory for medium temperature applications.	Truck and automotive rear axles. General use.	Satisfactory as general purpose material where temperature permits.	General purpose Buna N applications.
B-94	Buna N	—60°F/250°F	100	100					Excellent against aromatics and some military aircraft oils, fuels.
B-95	Buna N	—30°F/225°F	100	100					Good dry running compounds for applications requiring high durometer stock.
C-6	Buna N	—30°F/225°F	100	100			Excellent for semi-rough axles. Has good wear qualities.		Good for pressure seals due to high durometer and clean trimming.
L-28	Acrylon BA-12	—30°F/300°F	400	125	Good for temperature range indicated.	Satisfactory in single lip construction.	Sealed bearing high temperature applications.	Satisfactory for automotive use. High temperatures.	Satisfactory for high temperature general applications. Can be used with EP or GL-4 oils.
L-34	Hycar PA-21	0°F/300°F	400	115	Good for temperature range indicated.	Dual lip limited contact for high temperatures.	Sealed bearing high temperature applications.	Satisfactory for automotive use. High temperatures.	Satisfactory for high temperature general single or dual lips. Ok with EP or GL-4 oils.
S-48	Silicone*	—80°F/400°F	1500	150	Excellent high and low temperature life.	Silicone Compounds Not Recommended With EP Lubricants at high temperatures.		Excellent for general engine use. Suggested for premium gasoline and Diesel engines.	Excellent wide range material. Avoid use in EP and GL-4 oils.
S-49	Silicone*	—80°F/300°F	600	130	Good at high and low temperatures.			Very good for general engine use; premium gasoline and Diesel engines.	Very good wide range material. Avoid use in EP and GL-4 oils.

*Silicones require special stabilization for satisfactory use in aromatic oils at high temperatures.

NATIONAL SEAL
Division, Federal-Mogul-Bower Bearings, Inc.
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MAIL THE CARD TODAY

Design News

August 4, 1961 Vol. 16 No. 16

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SOUNDING BOARD

FOR OUR READERS

Automotive Braking

Regarding your article, "Air Chamber Compresses to Equalize Braking Force", in the June 5 issue of DESIGN NEWS, it is stated that a car skidded to a stop from 90 mph in a distance of 100 ft.

Now, considering the basic equation:

$$v^2 = 2as$$

$$\text{we get } 132^2 = 2(a)(100)$$

$$\text{or } a = 87.12 \text{ fpsps}$$

Now, maximum deceleration or acceleration of a car or similar vehicle is given by:

$$a = \mu G$$

Hence, it follows that for the car in question

$$\mu = \frac{87.12}{32.2} = 2.7.$$

Such a friction coefficient value surprises me. If you would forward to me information regarding how I can build such a friction coefficient into my car, I shall be able to out-accelerate that toothy grinning kid in the old jalopy at the stop light every morning.

H. J. OVERAL
National Water Lift Co.
Kalamazoo, Mich.

It is difficult for me to believe that any introduced "pedal softness" could enhance the performance of the hydraulic braking system of an automobile.

The wheels of an average car traveling at 90 mph rotate at approximately 17 rps. An out-of-round drum could not be followed by a brake shoe for full contact at this speed, with or without an "equalizer".

S. E. KOTZ
Research Engineer
Fairbanks, Morse & Co.
Kansas City, Kan.

• Stopping distance of 100 ft from 90 mph is overly enthusiastic. Tests were not conducted in an engineering manner. Do-Mor Brake Engineering Co. has agreed to perform a witnessed test to demonstrate stopping distances on the same vehicle equipped with and without their brake system. Results will be published.

There is variation in published stopping distances, deceleration and brake efficiency at 70 mph. Uniform Vehicle Code requires minimum deceleration of 17 ft/sec/sec, equivalent to braking force of 52.8 percent of gross vehicle weight, when applied to vehicle stopping from 20 mph. Stopping distance shall not exceed 25 ft.

NAME OF ORGANIZATION	*STOPPING DISTANCE at 70 mph (feet)*	*DECELERATION ft/sec/sec*	*BRAKE EFFICIENCY percent*
Yellow Cab Company of Calif.	245	21.51	66.8
Calif. Highway Patrol*		17.41	54.1
S. Calif. Edison	304	17.34	53.9
U. S. Bureau of Public Roads			
average performance	289	18.3	56.9
85 percentile performance	453	11.6	36.0

*California Highway Patrol shows a stopping distance of 261 ft at 65 mph. This represents a deceleration of 17.41 ft/sec/sec and a brake efficiency of 54.1 percent.

Decline and Fall

Your "Decline and Fall" article in the June 1961 issue of DESIGN NEWS should be sent to President Kennedy and all members of the House and Senate as well as all heads of state and local governments and all newspapers throughout the country. . .

JOHN KOSAR
Anchor Engineering Co.
Long Island City, N. Y.

Your last sentence, ". . . Are we witnessing the decline and fall of the United States?" is to be answered, "Yes", we are witnessing the decline and fall, but you are not putting your finger on the real issue.

The real issue is the preaching and philosophy of security from the cradle to the grave by the government of the United States and by vote-seeking politicians who are only interested in getting themselves elected, and whose interest is not the real welfare of the United States. People that no longer have anything to fight for become lazy and fat, and that is exactly what we are getting to be.

Why don't you tell the real facts instead of circumscribing them with some language that does not tell the real issue.

K. HELLINGER
Rochester Ropes, Inc.
Culpeper, Va.

• **But who elects our politicians?**

Freedom of the Press

I have just read your editorial entitled "Freedom of the Press" as it appeared in the May 22 issue of DESIGN NEWS. I was very much impressed with this statement and would appreciate your permission to republish it with proper credit to your company. Is this possible?

DAVID BERDAN
Buck Engineering Co., Inc.
Freehold, N. J.

• **Permission granted.**

Research Results—Dirt Cheap

Did you know that the results of probably 75 percent of research projects conducted by government agencies are available to industry for the ridiculous average sum of $1.50 each? For this modest sum you can have the results of months of research in fields covering the gamut of engineering.

Such is the picture presented to me in Washington by James E. Wheat, Chief of the Publications and Public Information Division of OTS. While DESIGN NEWS has long made use of limited material from the Office of Technical Services and frequently lists available papers, it took a personal contact such as this to bring home the value of this busy but small government agency.

The OTS has a total of only about 150 people. In Washington this is a very modest empire indeed. These few people managed to publish and distribute some 8000 military and some 6000 nonmilitary research reports and translations during 1960. With the same personnel they intend to increase this total in 1961 to about 20,000 military papers with about the same 6000 nonmilitary papers. Most of the increase results from reports coming from the Armed Services Technical Information Agency which will now be distributed by the OTS. During 1960 alone, some 400,000 copies of research reports have been sold to industry.

In addition to these activities, the OTS is also charged with the administration of the National Inventors' Council; for the issuance of Commercial Standards and Simplified Practice Recommendations; for compiling and publishing directories of national trade associations; for administration of part of the Technical Aids program of ICA.

The OTS is important to engineering. Through the publication of the results of government-sponsored research, it makes available to industry knowledge that otherwise might take months to acquire. You can take advantage of this service simply by sending for various reports in fields that may be of interest to you. In addition, DESIGN NEWS will publish entire papers from time to time on subjects of general interest. Should you need the answers to specific questions that could possibly be answered by the OTS organization, you can write either to our editors or directly to the OTS.

J. P. Dubois

Executive Editor

DESIGN SPECIAL REPORT NEWS

Application of X-Y Recorders

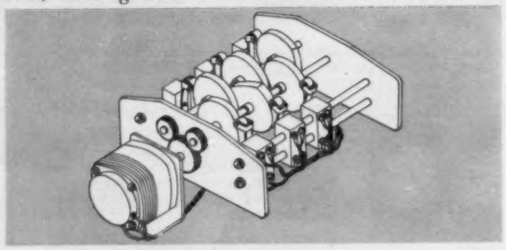
Transducers and Circuitry Extend Use of Plotters in Design Field

Edward W. Schrader, Western Editor

Variables, especially of the type Y=f (X), enter into the work of the design engineer continually. In fact, most engineering is based on a knowledge of the relationship between two variables such as speed versus torque, resistance versus angle, strain versus temperature.

The X-Y recorder provides the engineer with a means of observing tests and performing inspection without having to reduce point data and then making the necessary graphical plot.

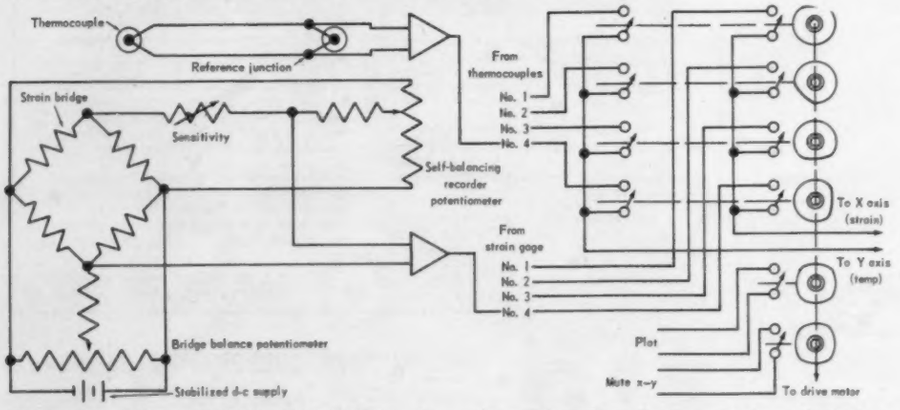
In mechanical engineering, the physical data usually is converted to an electrical signal by means of a transducer and then introduced directly into the X-Y plotter as two electrical signals. There are many interesting applications of X-Y plotters, however, dealing with unusual transducers which do more than merely convert a mechanical observation to an electrical signal. They may transform this signal into a logarithm, a differential or an integral of the basic variable, extending the use of the X-Y recorder to other areas.



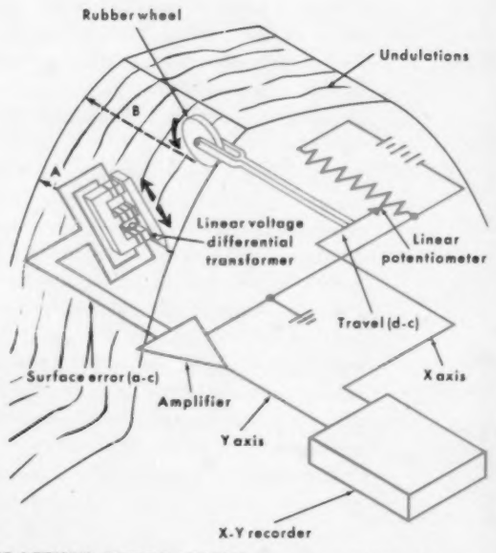
Consider, for example, extremely large gears used in ship propulsion. To reduce the noise generated by the meshing surfaces of the teeth, the surface finish must be controlled accurately. Such gears are often 10 to 20 ft in dia and about 1 ft in thickness. Hobbing machines are equally as large. The problem of surface finish occurs as undulations or long periods of variations in the machined surface of the gears. By use of appropriate transducers, variations in the surface finish across the hard face of the gear teeth may be plotted.

In research, strain versus temperature or other environment may be recorded on a continuous basis over several points. By means of an automatic scanning unit strain-temperature, representing X and Y components, may be plotted as series of points for several channels or sensor spots.

Measuring the speed-torque relationships on a motor makes another interesting example of an application of an X-Y plotter. The polar form of New-

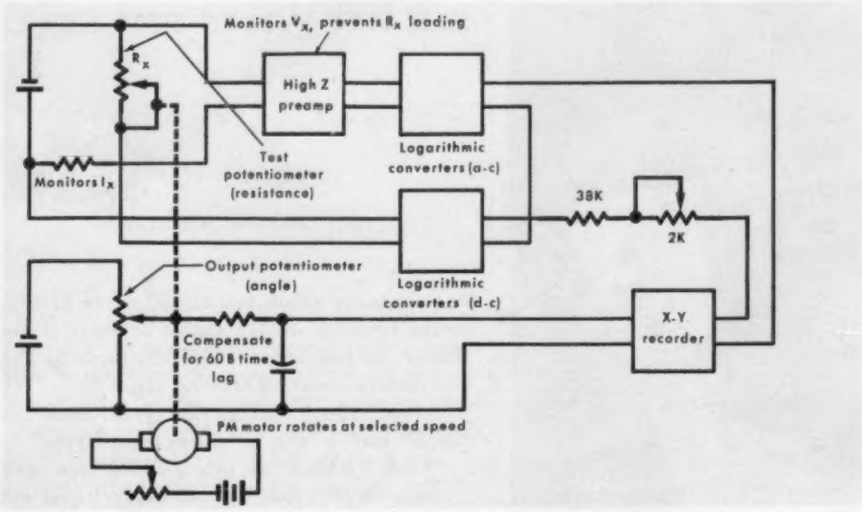


STRAIN-TEMPERATURE RECORDING in multichannel system. Scanner samples each of four channels at discrete intervals. Resultant coordinant is plotted in point form. Y-axis records temperature using copper-constantan thermocouple. Strain-gage channel records on X-axis, using input from 4-arm strain-gage bridge and balance, excited by floating d-c power supply. Limit switches trip by motor-driven cams to successively record point values every 3 sec.



PLOTTING UNDULATIONS in surface finish of large gears. Probe attached to linear voltage differential transformer (LVDT) senses variation in depth of cut from reference point. Output of LVDT, after preamplification, connects to Y-axis of recorder. Linear potentiometer, with wiper connected to rubber wheel, produces signal proportional to position across gear face. This output supplies signal for X-axis. Inspection fixture contains LVDT and potentiometer and locates transducers accurately as it moves across gear teeth.

PLOTTER introduces time delay in process or system by distance separating writing and reading arms of recorder. This variation utilizes continuous paper transport system and writing pen, whose head displacement is proportional to coordinant. Readout arm is spaced down paper, as desired for chart speed. Delay time is variable from 4 sec to 7 minutes by proper setting of two variables. In pickup assembly, light source illuminates paper in vicinity of line graph. Reflected light strikes oscillating mirror, which redirects resultant beam to photocell. When head is not directly over trace, phase-sensitive error signal is developed, amplified and applied to servosystem of recorder. Balancing action of servo cancels error signal and returns head to position directly over trace. Optical head follows pigment-type inks better than dye-type inks because of infrared spectral response of photocell. Graph paper lines of dye ink do not interfere with optical follower. Output of reading arm may be used to control process or machine. If two pickups are used, they may follow upper and lower boundaries of two traces to give integrated output of nonlinear functions.



POTENTIOMETER TESTER plots resistance versus shaft position as Y and X values, respectively. Output pot travels at selected, constant speed during test. Variable speed control allows from 15 to 60 sec for full rotation of potentiometer. Test pot is ganged to output pot. Signal representing logarithm of test resistance drives X-axis of recorder.

$$R_x = \frac{E_x}{I_x}$$

$$\text{Log } R_x = \text{Log } E_x - \text{Log } I_x$$

This signal is output voltage difference of two logarithmic converters. Each converter provides d-c output proportional to logarithm of a-c or d-c input.

ton's second law of motion is used,

$$T = J\alpha$$

where:

T = Torque
J = Polar moment of inertia
α = Angular acceleration

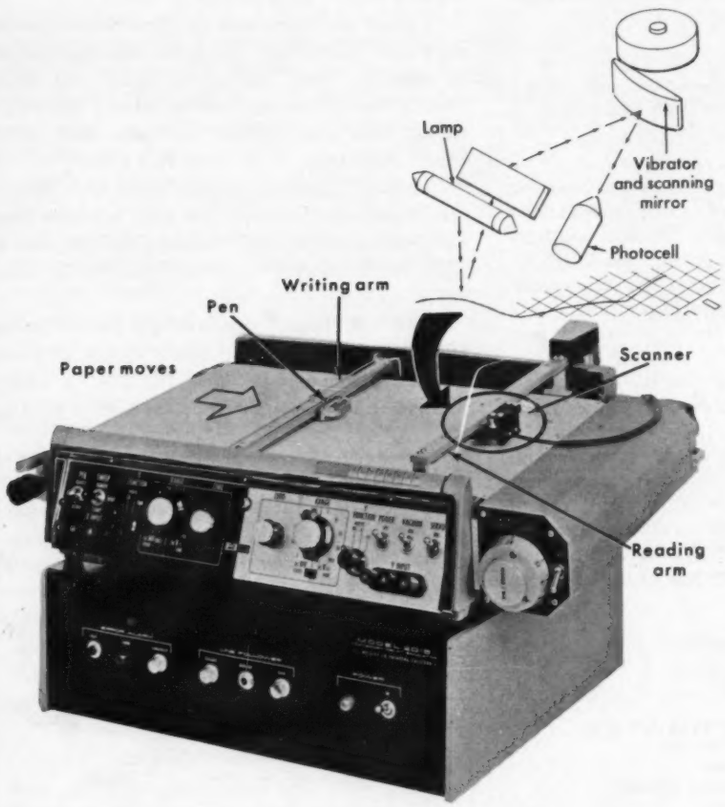
The angular displacement with respect to time may be measured with a tachometer, thus providing an output voltage representing speed. A transducer, in the form of a differentiating, passive network applied to this voltage, will provide acceleration. Therefore, for a given moment of inertia or load, a motor may display its torque versus speed characteristics by actually plotting acceleration versus speed.

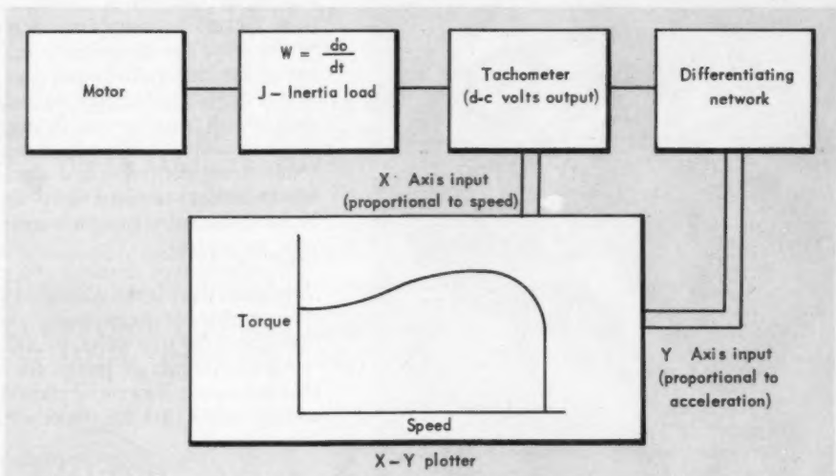
Logarithmic converters further extend the use of plotters. They produce d-c output voltages proportional to the logarithm of the positive peak amplitude of the input voltages. Such a converter is useful in plotting frequency characteristics of filters, transformers, networks and similar devices.

A standard audio signal generator, equipped with a motor drive and an output potentiometer on the frequency control shaft, is used. With a constant voltage applied to the pot, the variable output gives a signal for the X-axis of the recorder. This signal accurately represents frequencies generated, when plotted on semi-logarithmic paper since the oscillator's output frequency is inherently a logarithmic function of the control shaft position.

The output of the signal generator is fed to the equipment being tested and the output of the test article is connected to the input of a logarithmic converter, whose output in turn drives the Y-axis. This gives a decibel increment along the linear scale of the paper. A Bode plot of amplitude in db versus frequency on the log scale results.

Technical information for this article was supplied by F. L. Moseley Co., Pasadena, Calif.





RECORDER SPEED-TORQUE CURVES. By fundamental physics, torque is proportional to acceleration. From standstill, motor accelerates constant inertia load to full running speed. D-C tachometer, firmly mounted on rotating shaft, measures voltage as it varies from zero to maximum. Differentiating network takes first derivative of this voltage (acceleration) and supplies this signal to plotter for Y-axis. Speed is proportional to voltage output of tachometer and this voltage is supplied to X-axis to recorder. Pen traces speed-torque curve of motor under test.

SEEN AND HEARD

LUNCHEON TOPICS

Lars G. Soderholm, Midwest Editor

As soon as the whistle had blown, a thick baloney on rye sandwich whirled around on his stool and startled the peanut butter and jelly on white who was leaning across his drawing board.

"Wow," said the baloney on rye, "I never saw the 'old man' as sore as he was this morning."

"Yeah," replied the peanut butter and jelly, "I guess they've really had him over a barrel with all the time it's taking to get this job out. The sad part is, the job needs all the time we're giving it. The salesman surely wasn't thinking when he picked it up."

"It's too bad," said the baloney on rye, "that we have to end up with all the problems. Every time something like this happens, the salesman already has his commission but the company doesn't make any money on the job and I'm reminded of the fact when I go to ask for a raise."

"I guess every engineering department spends more time figuring out what to do than they spend in doing it," said the peanut butter and jelly. "Isn't it funny how we have to scratch for information and work around problems that never should have come to us in the first place?"

"Uh-huh," said the baloney sandwich, "there's your engineering shortage for you. With the time we spend on other stuff, including the 'old man's' work sheets, we don't have much time left for what we're supposed to be doing."

"Isn't it a laugh," snickered the peanut butter sandwich. "The 'old man' has a couple of forms which are supposed to have the clue to what's happening to our engineering time. He's holding

part of the answer in his hand; we spend our time filling out his forms."

"It isn't funny," said the baloney on rye irritably, "as long as engineering doesn't show a profit they'll keep trying one thing after another to make it pay. That includes those weird economy drives where using old pencil stubs and writing on scrap paper is supposed to put us back in the black."

There was a short period of silence while the "old man" passed down the aisle on his way to the water cooler to wash down some pills.

"Calm down," suggested peanut butter and jelly. "Engineering always was the whipping boy for everything that went wrong. If the salesmen can't sell it, we designed it wrong. If the shop has trouble, we designed it wrong. It's the old game of second guessing and you can't beat it."

"The trouble is that nobody seems to understand that the stuff that comes in here takes plenty of work to turn out. Even if we get a job that's impossible, it takes a couple of days to convince 'em that we can't make it. But the real clincher is, if you do pick up a poor job and turn it into a good one, what happens? Nothing! They expect both miracles and profits."

Baloney on rye nodded and choked as a swallow of hot coffee went down the wrong way.

Still overwhelmed by his eloquence, peanut butter and jelly went on, "There is nothing wrong with this department, or a lot of other engineering departments either, for that matter, that better understanding wouldn't cure. It's really just a matter of keeping in touch with what the other guy is doing. Communications—that's what we need, better communications. If the salesmen knew what we were doing, they would not get stuck with the things needing extra engineering unless we got paid for it. If we knew what the shop was doing, maybe we could work toward its strong side and stay away from where it has trouble."

"But somebody still has to dovetail all these things and that's where a good boss comes in. You need a sharp cookie the way things are going today—if you sit still a minute, your competition's got the jump on you."

"Yep—we need a lot of things, but we could . . ." His voice trailed off into silence as the "old man" returned down the aisle from the water cooler.

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MELETRON CORPORATION

POST OFFICE BOX 38546
950 NORTH HIGHLAND AVENUE
LOS ANGELES 38, CALIFORNIA

August, 1961

An Open Letter to Design Engineers:

There has been a change!

For many years, it has been the custom to specify "Barksdale-Meletron" pressure switches for purchase from the Barksdale sales organization. The relationship between Meletron Corporation and Barksdale Valves has now been terminated.

Therefore, you are now able to place all of your pressure switch orders directly with the MELETRON CORPORATION, or its distributors. We would like to suggest that you correct your files, if necessary, to read "MELETRON PRESSURE ACTUATED SWITCHES" which will assure your purchase of this long-established and dependable line of products.

As you may know, the inherent quality and functional stability of MELETRON PRESSURE SWITCHES has never been matched. Production criteria are traceable to the United States Bureau of Standards. And, Meletron Quality Control evaluates the performance of each unit before it leaves our plant. All MELETRON PRESSURE SWITCHES are warranted to perform to specified requirements.

The MELETRON line of pressure switches is able to meet every pressure-sensing requirement within remarkable ranges of pressure and temperature. These products possess singular resistance to shock, vibration, and other environmental conditions. There may be unusual -- or even unique -- applications which our Engineering Department can solve for you with dispatch and economy. Our engineers are at your service. Representatives in all principal United States marketing areas.

MELETRON'S 1961 catalog illustrating the line and providing technical information is now available. May we send it to you?

MELETRON CORPORATION

George A. Starbird

George A. Starbird,
President

GS:G

Pressure Switches • Vacuum Switches • Explosion-Proof Vacuum and Pressure Switches
Differential Pressure or Vacuum Switches

Elevator and Index Mechanism Handle Samples in Radiation Detector

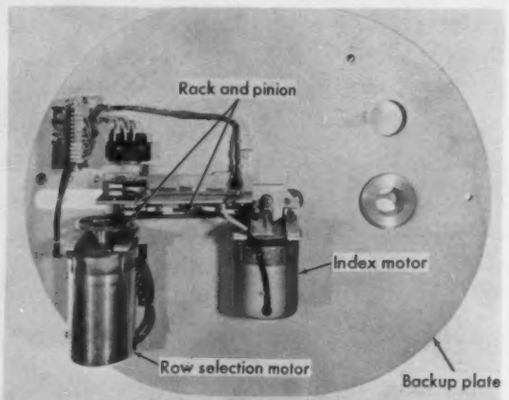
Lars G. Soderholm, Midwest Editor

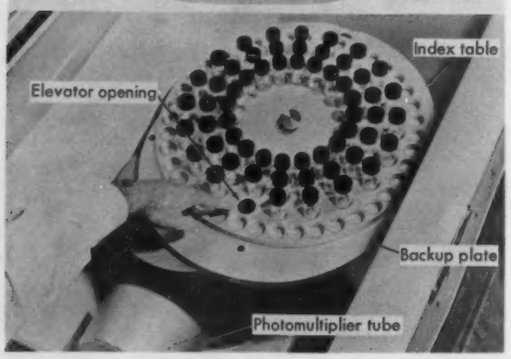
A liquid scintillation spectrometer used for counting tritium, carbon-14 and other beta- and alpha-emitting isotopes uses a two-step elevator and index mechanism to position and count up to 100 samples automatically. Two photomultiplier tubes scan each vial of radioactive sample and through electronic coincidence circuitry register all light pulses seen simultaneously by both tubes that fall within the ranges of two scalers. The accumulated totals of the two scalers are automatically printed out onto paper tape.

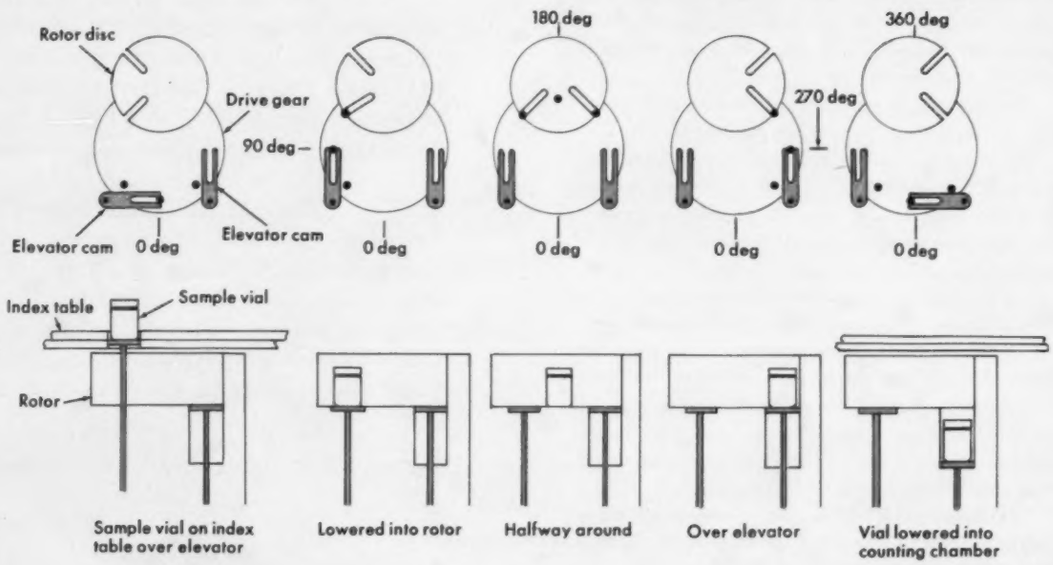
To obtain automatic operation, it is necessary to mechanically remove a sample vial from the index table and position it in a shielded counting chamber in front of the photomultiplier tubes, all without exposing the tubes to light. One hundred samples can be held in the index table which has four circular rows of 40, 20, 20 and 20 sample positions. The index table shaft is attached to a sliding member in the base which permits it to be moved to position a particular row for counting.

To bring a sample in position, the index table is translated and indexed so the sample vial is directly above an elevator that extends through the index table. Pins projecting from a drive gear in the base of the transfer machinery actuate a Geneva cam that lowers the sample into the transfer rotor. The cam also provides 180-deg indexing of the rotor to bring the sample over another elevator—also actuated by a Geneva cam which lowers the sample into the shielded counting chamber. After the necessary counting time has elapsed, the electric motor turning the drive gear is reversed and the sample returns to the index table by the same route.

When a sample is returned to the index table, an electric switch is operated that causes a separate indexing motor to rotate the table until the next sample is over the elevator opening. When one row

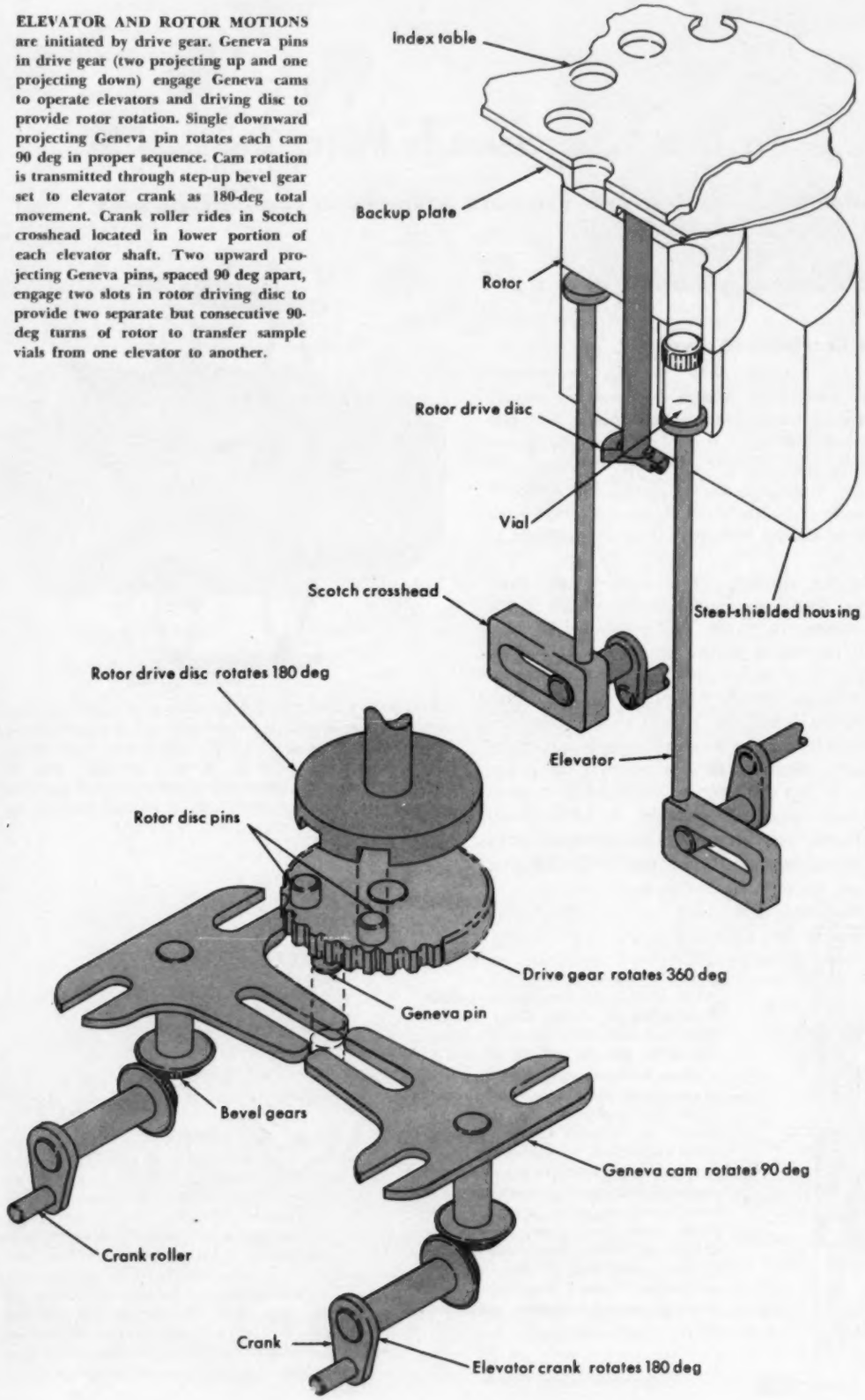


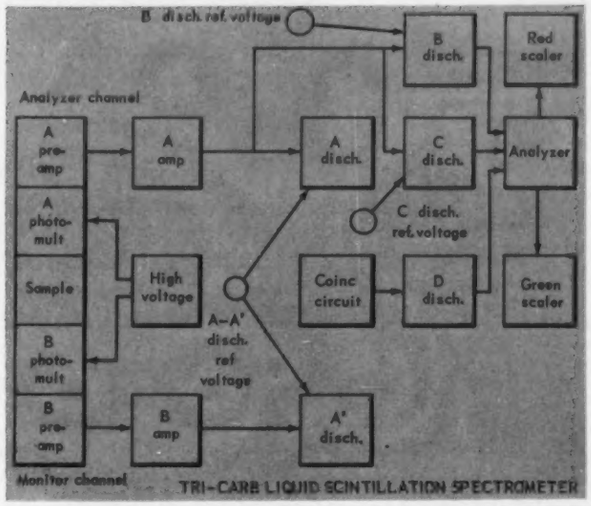




SEQUENCE OF MOTIONS in elevator and rotor operation is derived from an approximately 360-deg forward and reverse travel of driving gear. With sample vial located on index table, elevator holds vial in place during indexing of table. First 90-deg rotation of drive gear causes Geneva cam pin to lower elevator and sample vial into rotor. Following 180 deg of drive gear rotation cause two rotor pins to turn rotor 180 deg and position sample vial on elevator over counter chamber. Final 90 deg of drive gear rotation bring elevator and sample down, placing vial in position for radiation counting. Drive gear motor is reversed to return vial to index table.

ELEVATOR AND ROTOR MOTIONS are initiated by drive gear. Geneva pins in drive gear (two projecting up and one projecting down) engage Geneva cams to operate elevators and driving disc to provide rotor rotation. Single downward projecting Geneva pin rotates each cam 90 deg in proper sequence. Cam rotation is transmitted through step-up bevel gear set to elevator crank as 180-deg total movement. Crank roller rides in Scotch crosshead located in lower portion of each elevator shaft. Two upward projecting Geneva pins, spaced 90 deg apart, engage two slots in rotor driving disc to provide two separate but consecutive 90-deg turns of rotor to transfer sample vials from one elevator to another.





is completed, another electric motor is started which, through a rack and pinion arrangement, moves the center of rotation of the index table to bring another row over the elevator. When any preset number of samples has been counted or when the last sample in the last row is finished, the index table is returned to its original start position and the entire cycle automatically repeats.

The liquid scintillation spectrometer assays the contents of glass vials in which radioactive material has been dissolved or suspended in a solvent. A scintillator is used in the solution to convert the low-energy alpha or beta rays into light pulses that can be seen by the photomultiplier tubes.

Because of the extremely low energy level of the pulses being counted, there is a danger that thermal "noise" pulses produced by the photomultiplier tubes themselves may obscure the count of sample radioactivity to give false readings. To eliminate noise errors, the two photomultipliers are connected by a coincidence circuit in which both tubes must see an event simultaneously to record its occurrence. Additionally, both photomultiplier tubes are operated inside a freezer cabinet because low temperatures greatly reduce their internal thermal noise levels.

Signals from the photomultiplier pass through preamplifiers, amplifiers and discriminators. Here a pulse height analysis is performed by comparing the amplified input pulses with a reference voltage. Two scalers are provided, permitting counting of different energy levels or two or more isotopes of different energies. Information from the spectrometer is printed out on tape to provide an accurate permanent record.

Liquid scintillation spectrometers are used in radioactive tracer work to count alpha- and beta-emitting isotopes. While principally used in biomedical work, this method of tracing material also is being used in industry to check wear on parts and to trace flow in systems.

The Model 314-AX transistorized automatic Tri-Carb Liquid Scintillation Spectrometer is made by the Packard Instrument Co., Inc., La Grange, Ill.

Rotating Monovalve Transfers Air from Compression to Power Cylinders

Bovee Combustion Cycle Adds Transfer Phase at Constant Pressure to Increase Engine Efficiency

Edward W. Schrader, Western Editor

An internal-combustion engine employs compound stages for compression and power strokes. The heat cycle includes five phases; a reciprocating piston takes in air and compresses the air in the compressor cylinder, a single rotating valve transfers the compressed air by means of ports to the larger power cylinder whose reciprocating piston imparts power and exhausts the gases. Metered and pressurized fuel is injected in a solid stream into the compressed air transfer chamber.

Monovalve

The engine contains multiple pairs of cylinders. Each pair consists of a small air compressor cylinder and a larger combustion cylinder. The cylinders with their reciprocating pistons are arranged symmetrically around the drive shaft. The general shape of the engine resembles a large cylinder or drum.

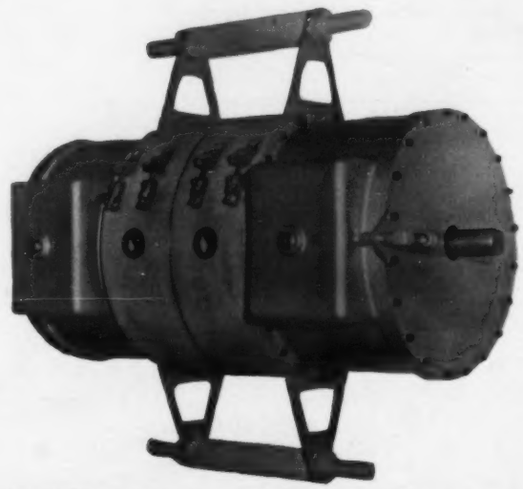
Centrally located along the axis of the engine is the combustion control valve plane. The valve is a single rotating disc. It is a gas pressure-balanced separator which commonly ports and communicates all compressor and power cylinders, while operating at 1/9 engine shaft speed.

The power shaft is crankless. Dual opposed wobble plates, mounted at each end of the engine, harmonically drive the power shaft.

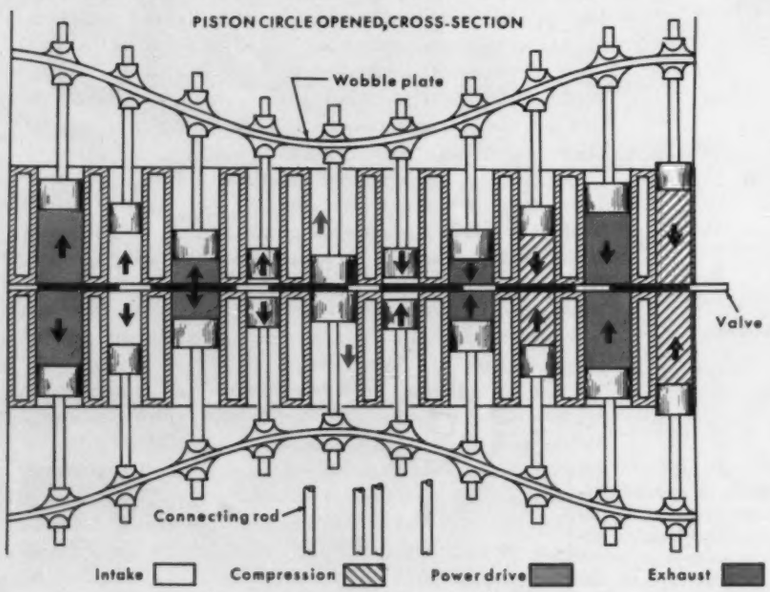
Bovee Combustion Cycle

The cycle has five phases: intake, compression, transfer, power and exhaust. A common plenum chamber supplies air for the intake phase. It is possible to use ram air pressure for specific power application requirements. The air cylinder compresses the air in the second phase. The compression ratio is 18:1. Under adiabatic compression, air pressure is nearly 700 psia at a temperature of 1025F.

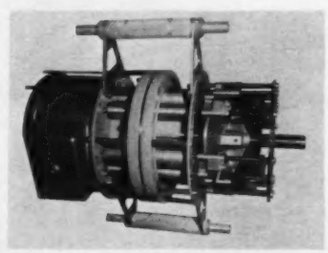
During the remainder of the compression stroke, the valve port passes the compressed air to the power cylinder. In transit, fuel is injected for mixing with the air. It burns to create a maximum pressure of 1130 psia and a final temperature of 4460F. This gas energy powers the driving stroke of the engine. When the exhaust stroke terminates at top dead center, the heat rejection is minimized appreciably. A small clearance between the piston and valve at top dead center permits full scavenging. Exhaust gases are expelled at temperatures and pressures well below the conventional diesel engine. Gases exhaust at 23.7 psia and 400F.



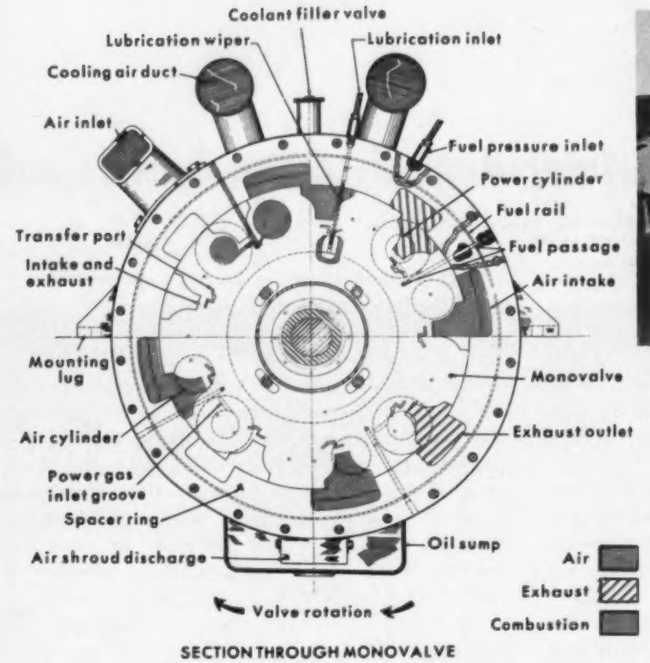
PROTOTYPE ENGINE was constructed of lightweight materials. It is expected that weight ratio of 1.50 lb per bhp in 100-hp range is attainable. Ratio will become increasingly favorable for weight reduction as size is increased. After 17 months of design and construction, engine operated for 20 hr running time in first series of tests. These tests showed need for improved valve sealing.



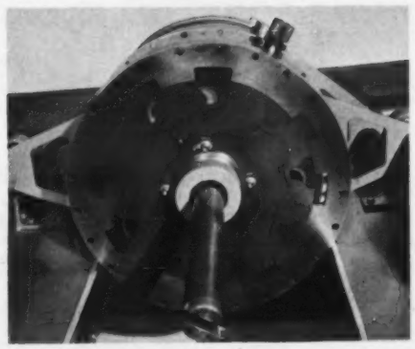
VIEW DIAGRAM illustrates sinusoidal wave action of wobble plates and inherent balance of dual opposed working pistons. In diagram, rotating monovalve is shown as sliding separator with ports. As plate valve slides to right, compressor pistons near top dead center force compressed air through transfer port in valve. Fuel enters air stream in transfer port. Gases expand to power driving pistons slightly past top dead center. Exhaust stroke of power piston is completed when power piston reaches top dead center. During drive stroke of power piston, companion air piston takes in air. During exhaust stroke of power piston companion air piston compresses air.



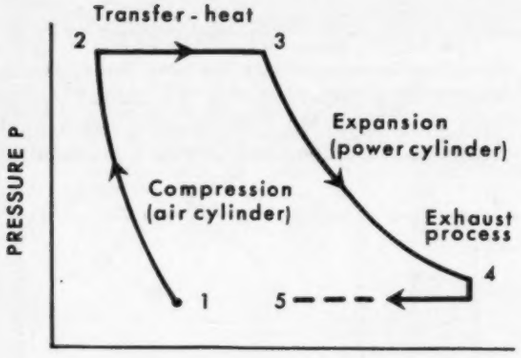
ENGINE with shrouds and covers removed shows general arrangement of opposing cylinders separated by plate valve. Shoes on guided reciprocating pistons drive wobble plate, which in turn transmits power to rotate output shaft. Engine can be started electrically or hydraulically. Combustion of fuel-air mixture occurs spontaneously at high compressed air temperature. Combustion power and mechanical rotation are variably controlled by fuel metering and are continuous until fuel injection is cut off. Engine can be idled to 80 rpm. Engine lugs at 300 rpm and it delivers nearly constant torque above this speed.



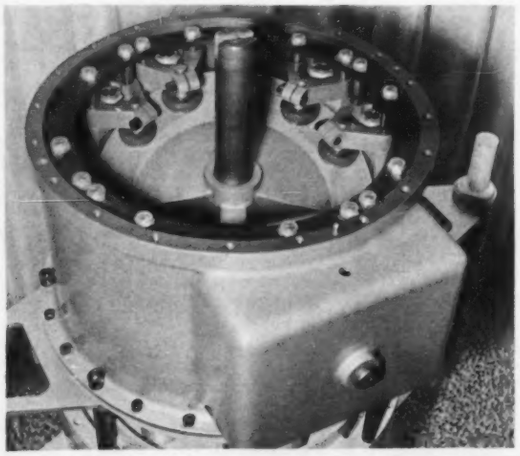
SECTION THROUGH MONOVALVE



MONOVALVE is rotating disc with tortuous-path transfer ports. Fuel is injected near center of tortuous path in valve. Compressed air flows from smaller air cylinder to larger power cylinder as valve face rotates. Cutouts in circumference of valve plate exhaust gases from power cylinders and admit inlet air to air cylinders.



PRESSURE-VOLUME DIAGRAM of Monovalve engine using Bovee cycle. Air cylinder bore is 1.375 inches. Power cylinder bore is 2.00 inches. Total stroke of both cylinders is 3.950 inches. Compression ratio is 18:1.



Calculated thermal efficiency for the cycle is claimed to be 64 percent. The ideal air cycle offers a thermal efficiency of 68.3 percent for expansion ratios of 18:1 with a gas constant of 1.396.

Assuming a conservative figure of 20 percent for losses resulting from change of specific heat, direct cooling and incomplete combustion, the attainable thermal efficiency is approximately 44 percent. Ricardo's analysis of thermal efficiencies proposes corrections to the ideal air cycle when applied to four-stroke gasoline engines. This latter work indicates a best obtainable efficiency of 66 percent of the corresponding ideal air cycle. The best attainable efficiency would therefore be 0.66 x 68.3 = 45.1 percent for a four-stroke gasoline engine. Shop tests of predecessor engines have proved the cycle efficiency.

The Monovalve internal combustion engine is a patented design of Ransom Bovee, Monovalve Motors Corp., Los Angeles, Calif. Michal Associates, Northridge, Calif., have engaged in joint venture with Monovalve Motors Corp. in a proposal to the Department of Defense for additional research and development of the engine.

Interaction of Locator Devices and

E. J. Stefanides, Central States Editor

A new housing for motor-generator exciter sets uses mechanical locator devices in conjunction with neoprene rubber seals. This procedure eliminates the need for hold-down bolts or other fastening devices. Combining greater accessibility with superior appearance, the redesign enables the motor and generator housing to be removed with a minimum of time and effort.

The problem involves three separate housings which must be secured to a bed plate and to each other. In previous designs, the housings were secured by 54 capscrews, 40 of these located within the housing and relatively inaccessible.

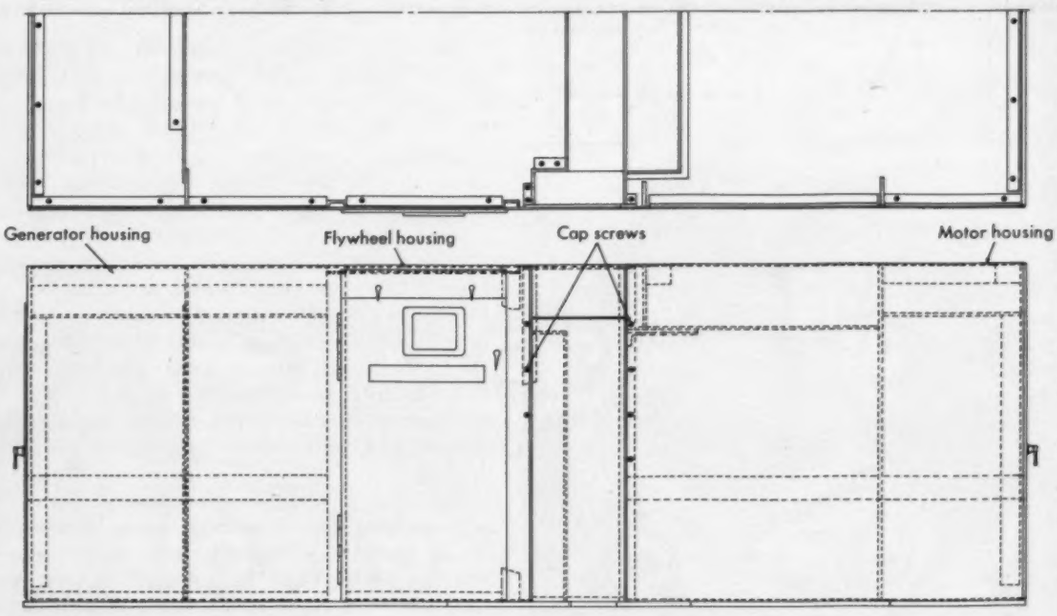
In the redesign, only the flywheel housing is bolted down. It is held to the bed plate by four capscrews and forms a rigid structural member against which the other housings are clamped by the interaction of mechanical locating devices and extruded neoprene seals.

The neoprene seals are attached to the inboard edge of the motor and generator housings. They provide tight closures and simplify assembly by minimizing the effect of manufacturing variations.

During assembly, the seals are compressed by the axial displacement of the housing caused by two locator devices attached to diagonally opposite corners of each housing. Guide plates of the locator devices slide down inclined planes of guide bars attached to the bed plate, thus utilizing the housing's own weight to compress the seals. In the engaged position, the cantilevered ends of the guide plates act as spring latches, providing further securement.

In addition to providing the axial clamping force, the locator devices also serve to locate the housing transversely. This function is provided by two other guide plates assembled to the housing locator device to provide an inverted-funnel-shaped passage for the bed plate guide bar. These permit the locating device to engage even though the housing may be as much as 2 inches away from the correct position for assembly.

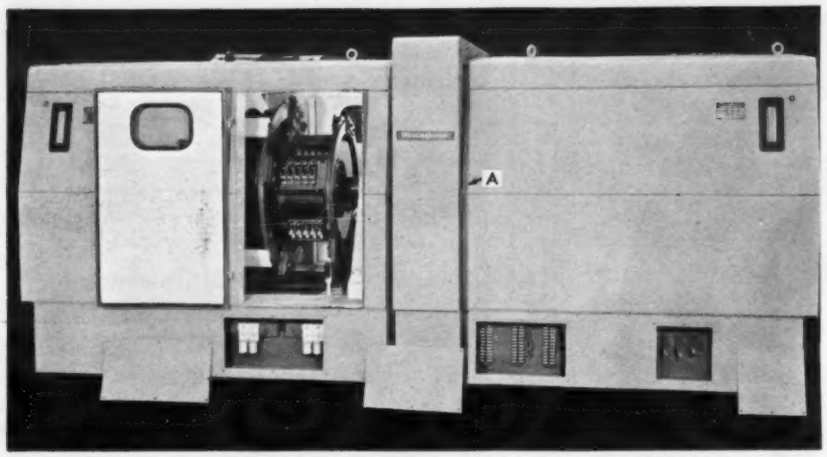
This housing design was developed by the Large Rotating Apparatus Dept. of the Westinghouse Electric Co., East Pittsburgh, Pa. Actual design work was done by A. J. Spisak of the Mechanical Section for D-C Motor and Generator Engineering.

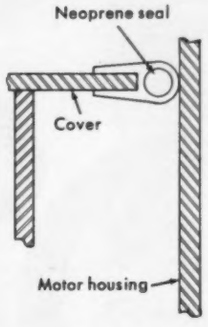


PREVIOUS DESIGN HOUSINGS were held to bed plate by hold-down capscrews passing through angles welded to housing and threaded into bed plate. Vertical securement was provided by bolting to flywheel housing.

Neoprene Seals Secures M-G Set Housing

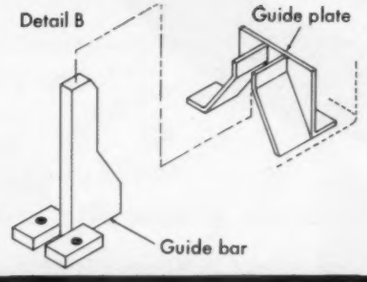
LIFT-OFF HOUSINGS are held in place by clamping forces developed by interaction mechanical locator devices and neoprene rubber seals.

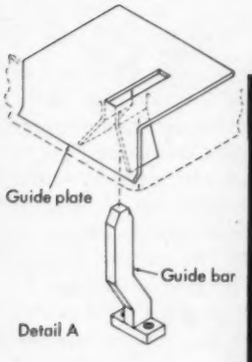


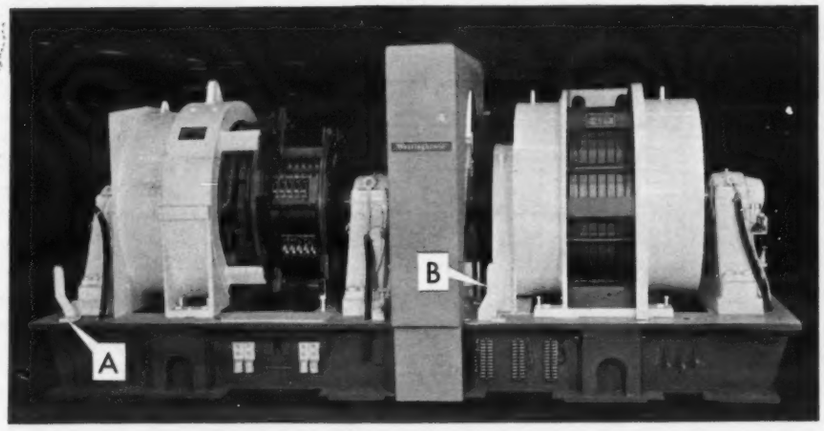


Detail A

EXCITER with motor and generator housings removed. Flywheel housing is bolted to bed plate, forming stiff structural member against which other housings are clamped. Top of flywheel housing is louvered to allow exhaust of motor and generator cooling air. Two housing locator devices are located diagonally opposite on corners of each housing. They locate housing transversely and develop axial clamping force. Housings are simply lifted off. During removal, locator device slot rides up back of guide bar, moving housing axially to prevent damage to seal.





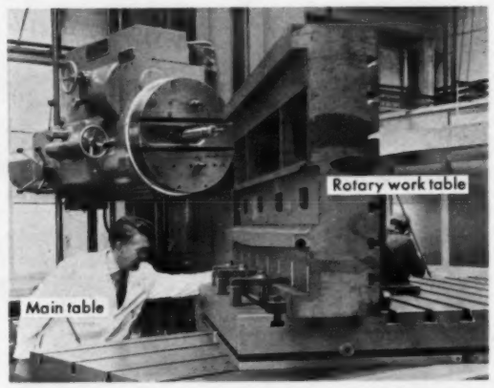


Chain-Driven Screw Jacks

Ronald W. E. Martin, British Editor

Problem:
Prevent tilt and distortion of the work table of a machine tool during lifting and rotation when the workpiece is unevenly distributed or load is concentrated at the circumference.

Solution:
A multijack lifting system, driven by a lead screw and nut which draw a single precision roller chain around a number of sprockets. Each sprocket forms part of a screw-jack, transmitting the load to a large-diameter ball track ring to lift the work table clear of the main table. Used in a horizontal borer, the lifting system insures an evenly balanced lift that allows offset loads to be rotated and positioned with ease.

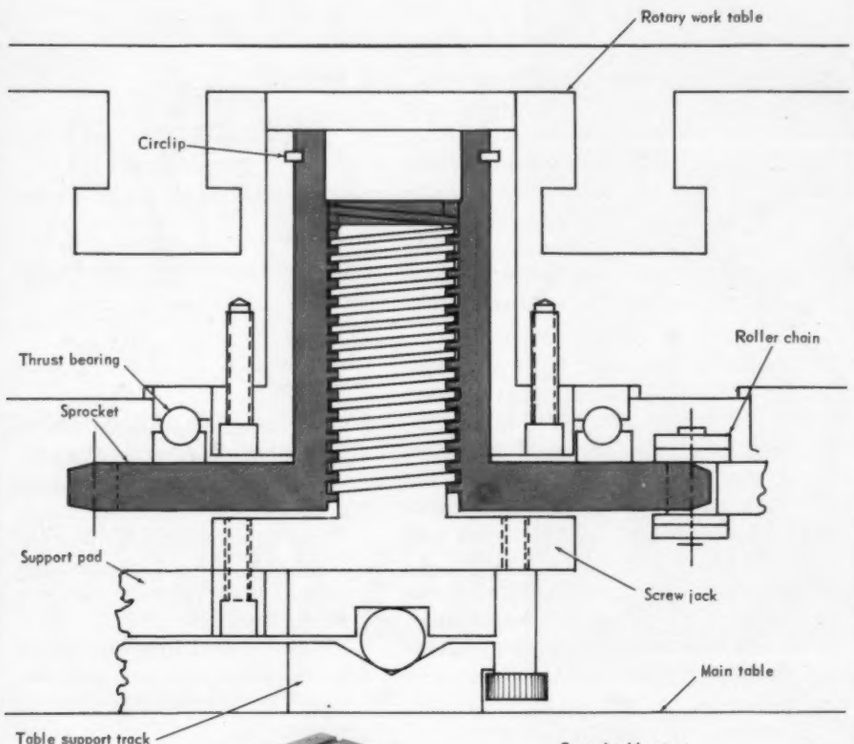


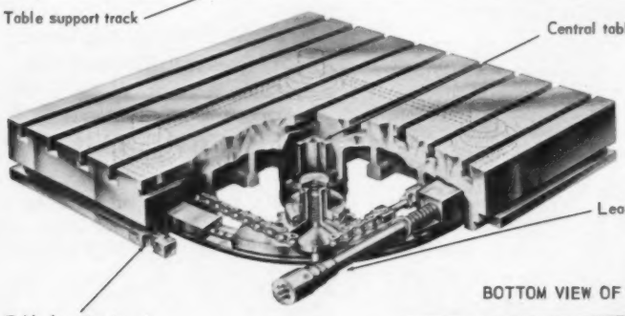
SCREW-TYPE JACKS insure even lift of rotary work table and enable offset loads to be turned easily by hand. Since lifting system is integral part of rotary table, whole unit can be lifted off central location and repositioned on main table.

The sleeve nut which holds the chain ends travels along the lead screw spindle carried in table flanges. Rotation of the spindle actuates all jacks simultaneously. Because of the high degree of balance achieved, designers were able to specify very low clearance between the nitrided steel central pivot of the rotary work table and the cast steel locating bushing on the main table.

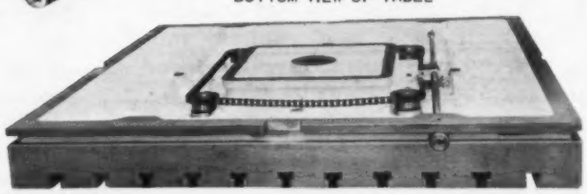
The rotary table was designed and patented by H.W. Kearns and Co., Ltd., Manchester, England.

Give Balanced Lift to Rotary Work Table





BOTTOM VIEW OF TABLE

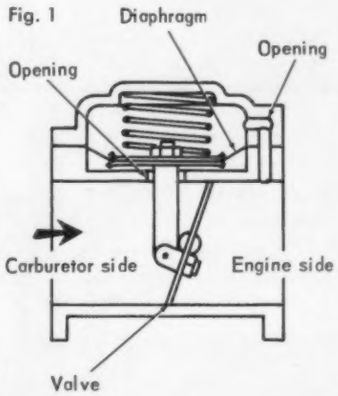


SYMMETRICALLY SPACED around rotary work table vertical axis, four or more jacks bear upon large-diameter track. Track supports rotary table on machine main table. Each jack has square-threaded lifting screw bearing upon upper race of track through thrust bearing and nonrotating support pad. During cutting operations, rotary table is clamped at all corners for maximum support, minimum table distortion or vibration. Accurate location is insured by steel inserts at each 90-deg position, or table can be clamped around its circumference.

PATENTS

Vacuum Control in Intake Manifolds

French Patent 1,243,806; Max Y.A.M. Serruys and Jean A. Hardy, Paris, France.



Sudden opening of the throttle in most I-C engines sharply reduces vacuum in the intake manifold, causing condensation of vapor. These effects usually are counteracted by use of acceleration pumps, with resultant excessive gas consumption.

This patented delay valve allows a smooth, economical speed increase by automatically limiting vacuum loss in the intake manifold. Fig. 1 shows vacuum control by static pressure difference actuation. Two sections of the intake are divided by an additional throttle butterfly valve, center pivoted and actuated by a lever connected to a diaphragm biased by a calibrated spring. Inlet flow pressure acts on the lower face of the diaphragm. Upper face of the diaphragm is connected to the engine side.

When the main throttle is opened suddenly, vacuum cannot decrease below the value which results from equilibrium between spring force and the difference of pressures on both sides of the diaphragm. Thus, when the motor accelerates, the depression varies progressively with opening of the additional throttle.

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

WORK DRIVE MECHANISM
U S Patent 2,984,955; Donald F. Price and William E. Happel, assignors to Landis Tool Co., Waynesboro, Pa.

UNIVERSAL JOINT
U S Patent 2,984,997; Robert D. Wight, assignor to General Motors Corp., Detroit, Mich.

HIGH ACCURACY BALL AND DISC INTEGRATOR
U S Patent 2,985,026; Sigmund Rappaport and John Kallenberg, assignors to Sperry Rand Corp., Ford Instrument Co. Div., Wilmington, Del.

HYDRAULIC PUMP
U S Patent 2,985,109; Walter Ernst, assignor to The Thompson Grinder Co., Springfield, Ohio.

HYDRAULIC COMPUTER SYSTEM
U S Patent 2,985,181; William O. Nixon, Grosse Pointe Woods, Mich.

BALL VALVE
U S Patent 2,985,191; Donald E. Backett and William N. Beckett, assignors to Beckett-Harcum Co., Wilmington, Ohio.

PROPELLER FAN
U S Patent 2,985,245; Ralph P. Maloof, assignor to National Frost Protection Co., Inc., Burbank, Calif.

DISC BRAKE
U S Patent 2,985,259; Richard H. Gardner, assignor to Clark Equipment Co., Buchanan, Mich.

CLUTCH
U S Patent 2,985,271; Lawrence A. Wilson, assignor to International Business Machines Corp., New York, N. Y.

PRESSURE SEALING VALVE
U S Patent 2,985,422; Clifford E. Anderson and Ronald A. Gulick, assignors to ACF Industries, Inc., New York, N. Y.

RELEASABLE WORK-HOLDING DEVICE
U S Patent 2,985,459; Emil Leiss, assignor to Lever Bias Machine Corp., New York, N. Y.

SNAP-FIT PLASTIC PIPE JOINT
U S Patent 2,985,469; Mark M. Bowman, Jr., assignor to Phillips Petroleum Co., Bartlesville, Okla.

BEARING-SEAL CONSTRUCTION
U S Patent 2,985,472; Otto R. Schoenrock, 138 N. Taylor Ave., Oak Park, Ill.

DESIGN NEWS — DESIGN IDEAS — ELECTRICAL

Interlock Relay Coordinates Automatic Fraction Collector

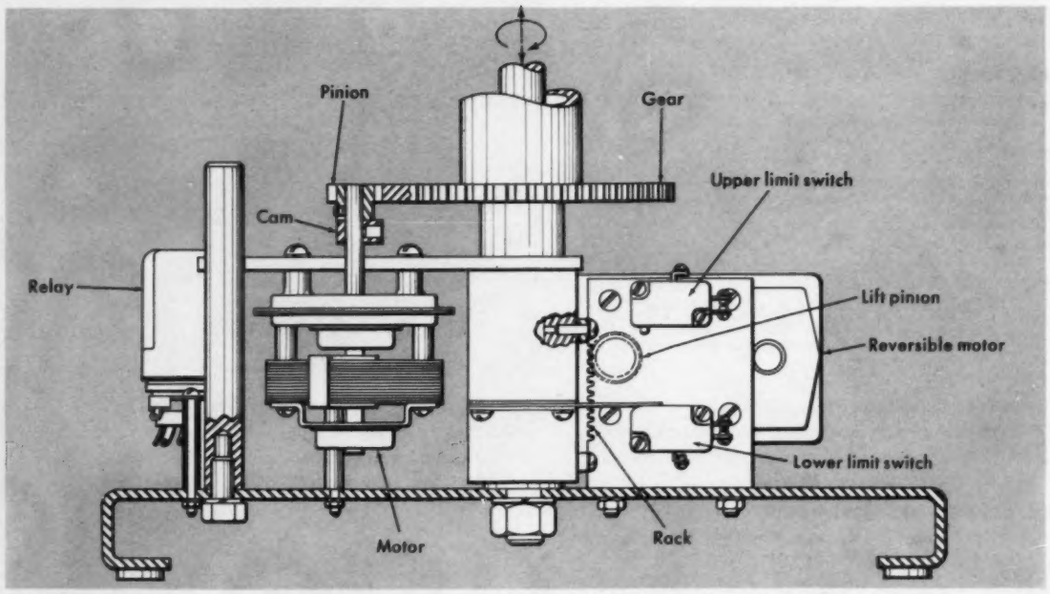
Lars G. Soderholm, Midwest Editor

An automatic fraction collector obtains relatively pure samples from a gas chromatograph through a detection and mechanical collection system. The system is coordinated through an interlock relay in the electrical circuit.

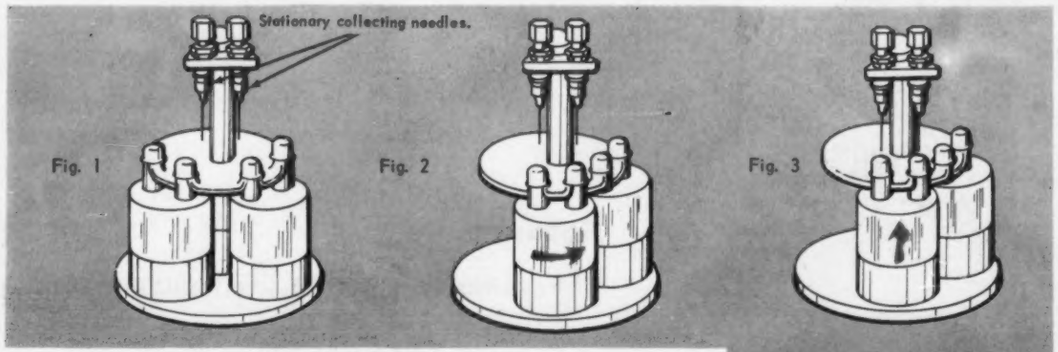
The gas chromatograph is used to separate complex mixtures with unknown constituents into relatively pure compounds. These compounds then can be transferred to a mass spectrometer for identification of the separated components.

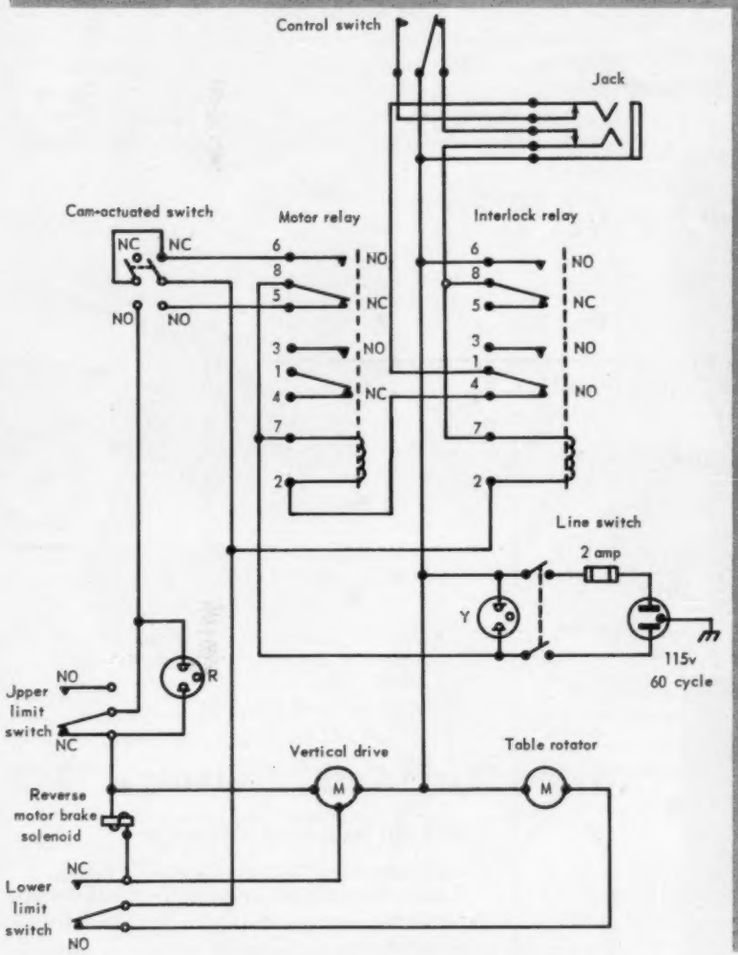
The new automatic fraction collector has six collection tube stations. When a sample fraction is detected electrically by a thermoconductivity cell, a sample collecting sequence is initiated in which the collecting receiver is positioned under the needle holder assembly and raised until the needles penetrate the bottle caps. After the sample has been collected, the sample receiver is lowered and either moves 30 deg to a rest position or into another collecting position.

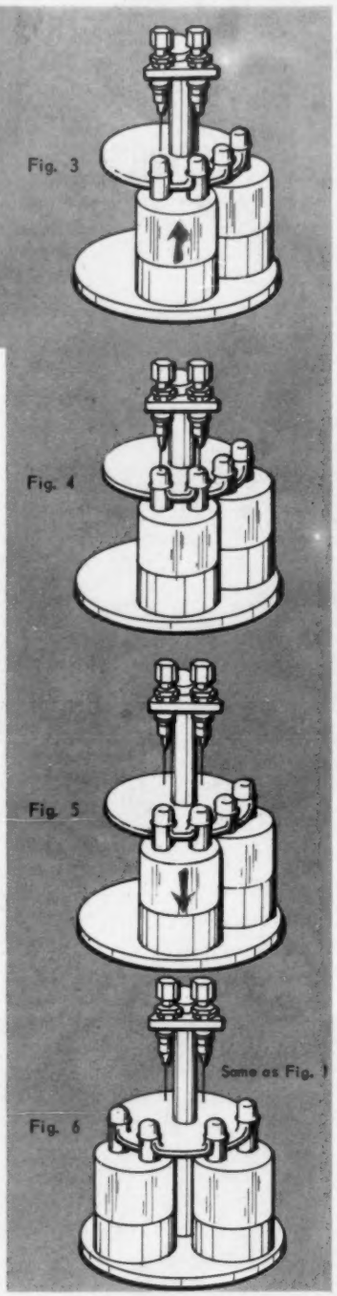
The automatic fraction collector can be set for manual or automatic operation. It is made by Central Scientific Company, Chicago, Ill.



MECHANICAL MOVEMENTS of fraction collector are coordinated by electrical circuit. Rotary motion is through electric motor that turns holder assembly through gear and pinion arrangement. Vertical motion is by reversible motors and rack and pinion. Position is determined by limit switches. Counterweight spring supports weight of holder assembly.







ELECTRICAL CIRCUIT provides for six primary operating positions of automatic fraction collector:

Fig. 1. "Rest" position is with table at lower limit of vertical travel and collecting needles between collection stations.

Fig. 2. When line switch is actuated and control switch flipped, motor relay is energized. Table rotates 30 deg, aligning receivers with collecting needles. Cam-actuated switch then stops and locks table rotation and starts vertical drive.

Fig. 3. As table rises, lower limit switch changes position. When table reaches top position, upper limit switch is actuated.

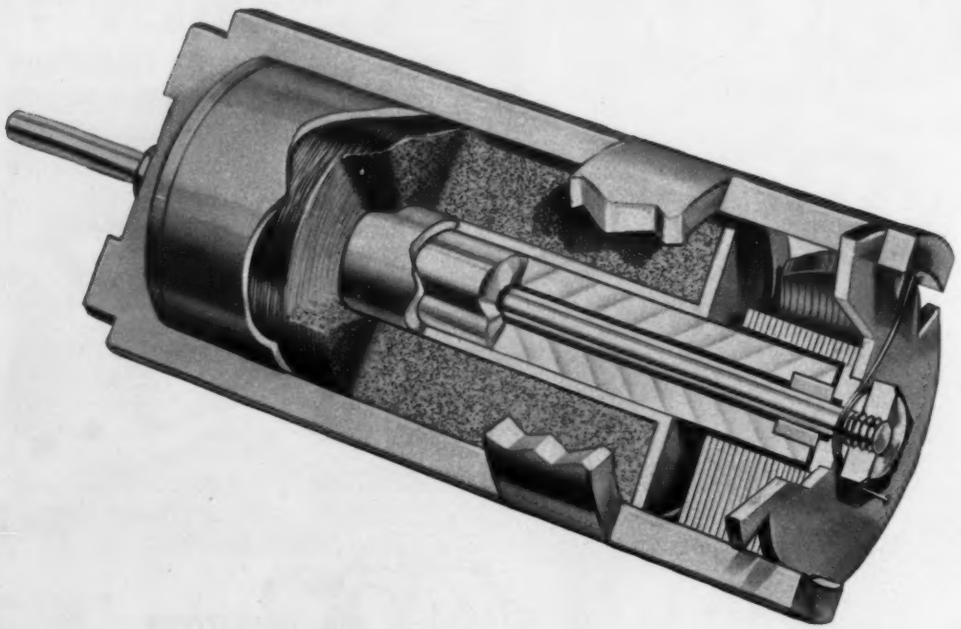
Fig. 4. Collecting position has all motor circuits inactive. All operations to this point have been automatic.

Fig. 5. Control switch is actuated to begin downward vertical travel. Once motor relay is de-energized and interlock relay is energized, control switch is bypassed. This permits direct travel to next collection station with no "rest" position.

Fig. 6. At end of vertical travel, lower limit switch stops vertical drive and starts table rotation. This is normally 30 deg to "rest" position where cam-actuated switch moves to cause all circuits to become inactive.

NEW PRODUCTS

Circle number on Reader-Service card for more information

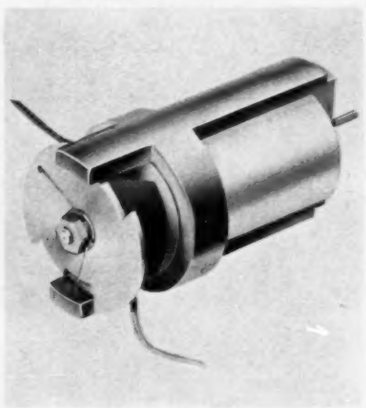


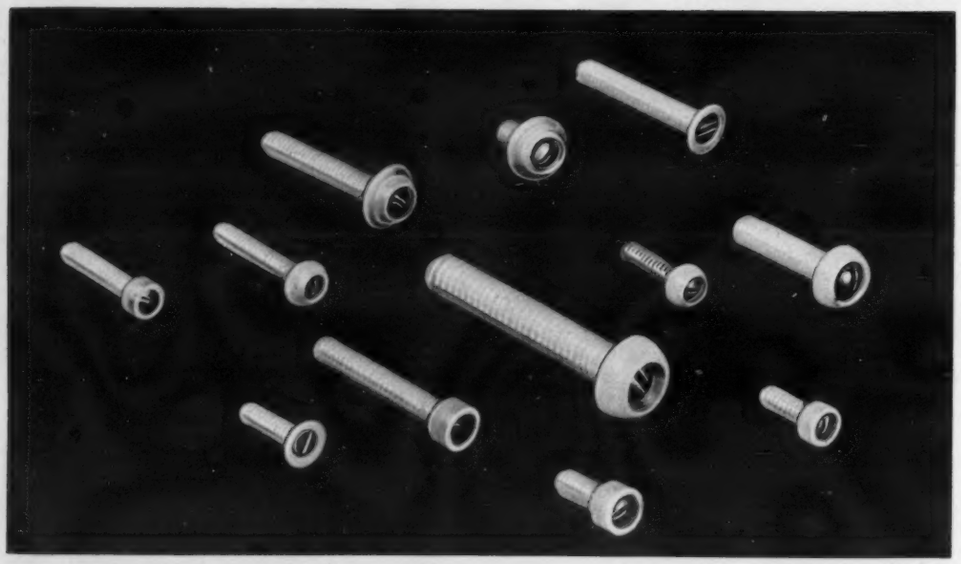
Rotary Solenoid 301

Requires Only 0.0033-Amp Input Current

A new MIL-1-22075 rotary solenoid requires less input current than a transistor. Type 9931-04 has only approximately 0.0033-amp input current at room temperature and 0.005-amp maximum at 29v d-c at −55C. Torque at 95C is 0.005 oz-in minimum. Voltage range is from 25 to 29v d-c. The rotary component is designed to operate flags in indicators to MIL-1-22075 and for other rotary-motion military applications requiring low input and 35-deg total rotation.

John Oster Mfg. Co., Avionic Div., Racine, Wis.





Nylon 'Steel-Core' Fasteners 302

Self Seal to Resist Vibration

Users of composite plastic-metal screws are assured prompt delivery of small lots (as few as 10 of a size) of nylon screws for R&D, prototypes, repairs and general use. Packaged in units of 10 and 100 for easy handling and storing, fasteners also are available in bulk for production requirements. Screws consist of natural-colored nylon outer threaded screw with cadmium-plated hardened steel core which is completely insulated. They are used in higher stress applications since they have up to 2-1/2 times greater torque and shear strength than ordinary nylon screws, with ability to withstand shock loading and vibration. Self-sealing and corrosion resistant, they are ideal for use with commercial liquids and gases. Round, fillister, flat and washer slotted-head screws are obtainable with 6-32 through 1/4-20 threads in lengths up to 1-1/2 inches.

Machine Parts Supply Co., 13 E. 37th St., New York 16, N.Y.

Miniature Threaded Inserts 303

Provide Substantial Savings in Space, Weight and Material

Permanent threads in soft metals are provided with screw-thread inserts produced in 3-48NC, 4-ONC, 4-48NF, 5-4ONC and 5-44NF. Inserts are designed to meet stringent size requirements in the miniaturization of aerospace instruments, electrical and electronic equipment, and other general industrial instruments. The only wire thread bushings on which military standard numbers have been issued, the stainless-steel inserts eliminate problems of corrosion, galling and seizure, and facilitate the disassembly and reassembly of equipment subject to inspection, maintenance or repair. For special applications, they are available on order in phosphor bronze, "Inconel-X", carbon steel and other metals. To facilitate ordering miniature-sized inserts and accessory tools, the manufacturer will provide on request a service bulletin with assembly specifications. A table lists nominal lengths of inserts and dimensions of tapped holes, assembled inserts and free inserts. Evaluation samples are available.

Heli-Coil Corp., Danbury, Conn.

FHP Gearmotors 305

Instant reversing, high constant torques, low sound level, compact size and a wide range of output speeds (any individual speed from 0.3 rpm to 500 rpm) are provided in two new gearmotors. Units develop up to 250 lb-in at 10 rpm and are available in 1/15-hp 220v, three-phase and 1/15-hp, 115v, single-phase. Ball-

bearing-equipped motors are combined with a heavy-duty gearhead, which utilizes carbo-nitrided, special-cut, alloy-steel generated gears and pinions to provide extremely long life. Felt oil reservoir lubricating system allows units to be mounted in any position. Base and panel mounting is provided standard.

New England Gear Works, South End Rd., Southington, Conn.

Circle 17 for Reader Service

Shakeproof Mounting Fastener 306

Available in two standard head designs—wafer and flat head—this line eliminates the need for countersinking to obtain flush mountings. Parts have multiple-thread, left-hand retaining sections and torque-increasing "nibs" under the head to prevent stripping in panel and to eliminate need for retaining nuts. The "locating and orienting" point consists of a lead-in cone and a smooth cylindrical section to bring nut into mating position with thread. The flat-head mounting screw

is suitable for plywood from 3/8-inch thickness and up. Lengths range from 1-1/4 to 1-3/4 inches. The wafer head can be used with plywood, "Masonite" or composition board in thicknesses of 3/16 inch and more. Wafer-head design is also suitable for use with punched holes. It is available in lengths from 3/4 to 1-3/16 inches. Shakeproof mounting screws are recommended for mounting speakers to panels, mounting electrical equipment and other applications where studs are required.

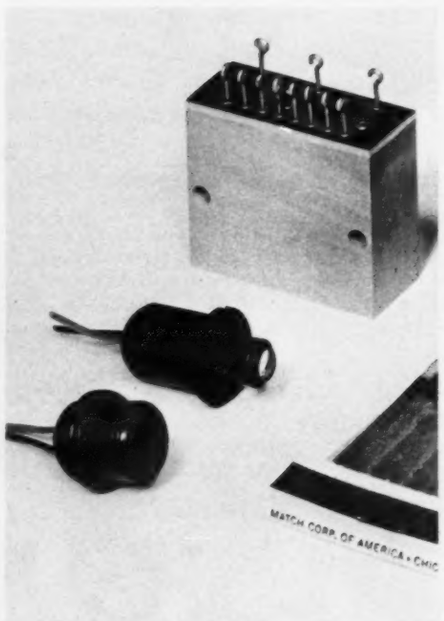
Illinois Tool Works, Shakeproof Div., St. Charles Rd., Elgin, Ill.

Circle 17 for Reader Service

Solar Sensors 307

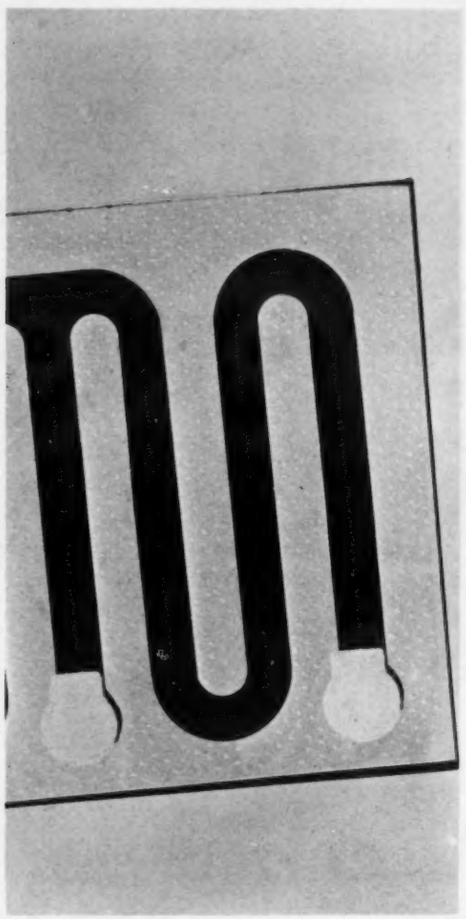
Designed for operation in an outer-space environment, these photoelectric sensors are used to provide high-performance servo control of rocket and satellite-borne sun tracker. Model EA-3 amplifier (shown with FE-3 and CE-3 sensors) is built to condition signals from sensors for either telemetering or servo applications. Weighing about 30g, the amplifier is a completely transistorized, low-drift device. As a single-ended amplifier, the output range is from 0 to 5v for telemetering or 2.5v (±2.5v) for servo control. Amplifiers may be used in pairs to provide differential output. Solar sensors can be furnished with various angular characteristics for coarse servo control, fine servo control, spin detection and aspect determination. Sensor assemblies weigh about 10g each. Components are constructed to withstand the temperature, vibration and shock of satellite flight.

Ball Brothers Research Corp., Boulder Industrial Park, Boulder, Colo.



Compact Heating Element 308

Useful as a low-temperature warmer or in spot heating applications, this unit features a glass panel selectively coated with a metallic film. The film is applied to form an electrically conductive path, permitting a maximum amount of heat to be generated from a minimum-sized panel. Temperatures in excess of 300C may be produced with

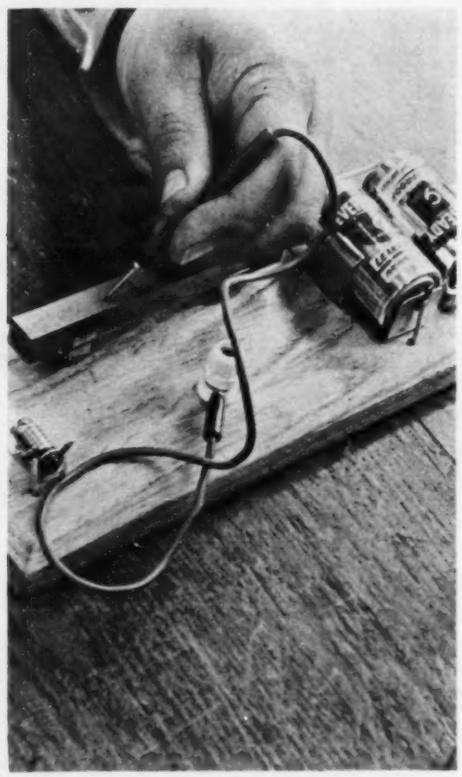


glass sizes from 1 to 27-3/8 inches square and from 3/32 to 1/4 inch thick. Resistance per square of coating can be varied from 6 to 100 ohms. Maximum dissipation is 10w per square of coated area. Infrared reflecting qualities of the film permit the unit to serve as a spot shield for delicate materials (the manufacturer states). Glass used is Pyrex brand No. 7740. Film will not normally rub, flake, peel or wear off.

Corning Glass Works, Corning, N.Y.

Electrical Conductive Plastic 309

A new plastic material offers ideal conductive properties for applications in waveguide, RF connectors and electronic components. Pilot uses of the material have found it particularly well adapted to the production of printed circuits where a flush surface is desired. The demonstration shows a 3v bulb being lighted by two 1-1/2v batteries wired in series with a probe and a bar of the new plastic material. A brilliant light is obtained when probe is applied to any location on the bar.



Mesa Plastics Co., 12270 Nebraska Ave., Los Angeles 25, Calif.

Flexible Adhesive 310

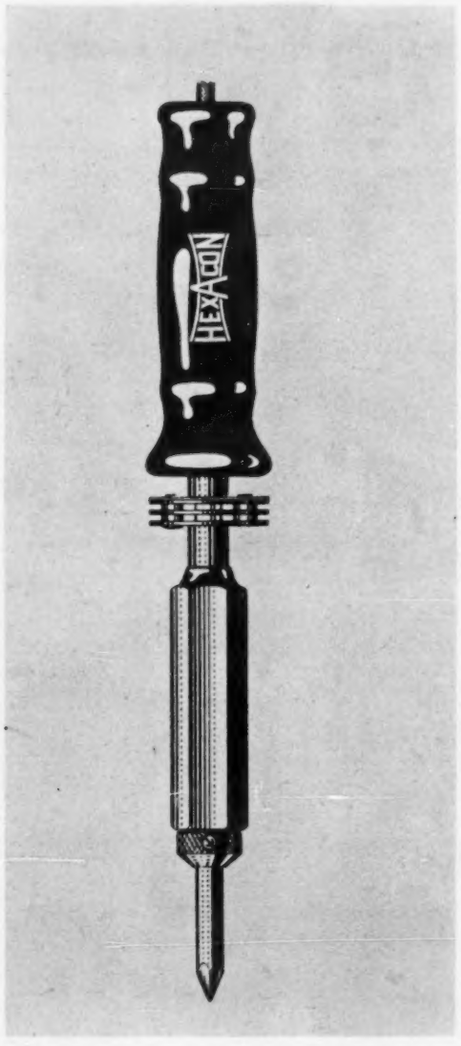
A general-purpose adhesive is useful for bonding natural and synthetic rubber, vinyl plastic, fabric, leather and wood to itself or to glass, steel, iron, aluminum, phenolic plastic and other surfaces. It is permanently flexible. "CD 350" is a high-solids adhesive. It is fast setting, waterproof, exhibits good oil, gasoline and chemical resistance, and

resistance to outdoor weather. The cement will be of particular interest to plastic fabricators, jewelry manufacturers, rubber companies, public utilities and other industries that desire a tough, flexible and permanent bond with extremely high adhesion to many different surfaces. This material also has proved of interest to several companies for sealing or caulking purposes, including waterproofing of electrical systems.

Chemical Development Corp., Danvers, Mass.

EQUIPMENT

Soldering Irons 311

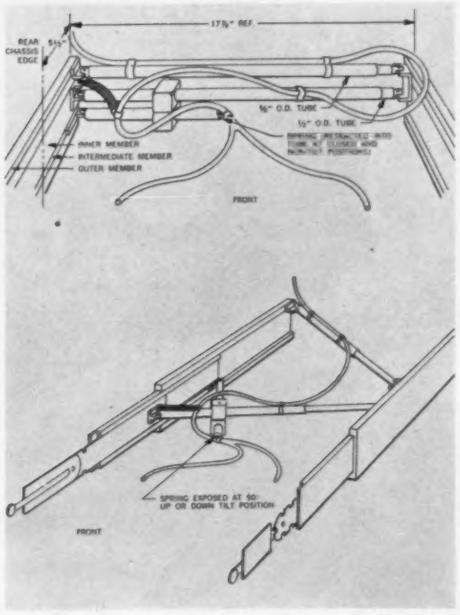


Production-line soldering irons feature cooler and more comfortable handle grip, shorter length, better balance, improved finish and more units in 33 different models. Included are plug-tip hatchet and super-powered irons, with tip sizes from 3/8 to 1-3/4 inches. Elements are of rugged alloy with high heat conductivity, together with nonfreezing tips to eliminate all tip-sticking problems. Irons have new quick-change element and terminal with ground-wire set screw, so that they can be changed over to three-conductor cord sets by the user without returning to factory.

Hexacon Electric Co., 636 W. Clay Ave., Roselle Park, N.J.

Telescoping Cable Carrier 312

Cumbersome cables connected to drawer-mounted electronic equipment now can be uniformly supported, regardless of drawer position, with a new cable-carrying precision mechanism. The "Power-Track Carrier" firmly secures cable, prevents entanglement with other stored chassis, eliminates vibration problems and compactly stores cable in minimum depth when the chassis drawer is in "closed" position. The device consists of two telescopic-action supporting arms, mounted to opposing sides of the three-member chassis slides. By expanding relative to slide movement, the arms automatically provide uniform cable

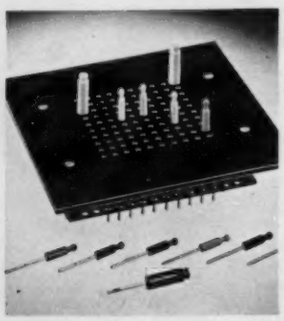


support throughout drawer traverse. In this manner, cable loading is transmitted directly to weight-carrying slides, avoiding any form of cantilevered support. Shock and vibration damage to cable is prevented, since cables are firmly secured to carrier. The mechanism occupies approximately 1 inch of storage space when retracted. Cable storage space at rear of chassis is determined by package conditions. The carrier is designed to meet applicable military specifications.

Jonathan Mfg. Co., 720 E. Walnut Ave., Fullerton, Calif.

Prototype Program Kits 313

This useful engineering aid contains an 8- by 9-inch "Sealectoboard", eight shorting pins and three component holders to permit complete programming functions for electronic and electrical systems. The device is a cordless program board providing complete switching functions at any coordinate on an X and Y axis. Switching action is made by inserting a pin which connects the contacts of the two axes. Component holders allow interpositioning of diodes or other components at any



point in the matrix. The 10- by 10-inch kit contains a larger board, 10 shorting pins and three diode holders. Kits are useful for breadboarding systems and actual systems programming, since they may be mounted in multiples for additional X and Y circuit connections. Also, kits may be used for programming test functions and procedures on assembly lines or programming machine tools with electronic controls.

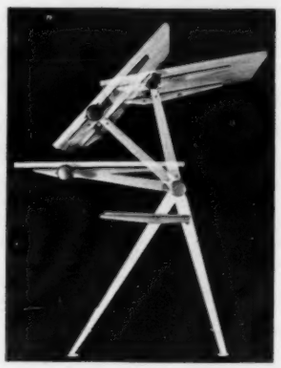
Sealectro Corp., 610 Fayette Ave., Mamaroneck, N.Y.

Circle 26 for Reader Service

Metal Drawing Table 314

Lightweight and easy to handle, the "Planofix" meets the needs of engineers, draftsmen, artists, designers and students. The frame of the drawing table is made of heavy-gage steel, U-shaped, and the connecting tube gives the unit a high degree of rigidity. Adjustable from a low horizontal position of 30 inches, for use with a chair, to a height of 46 inches, the table can be fixed at any intermediate position and adjusted to any inclination. A device on one leg of the frame permits adaptation to any floor condition, allowing unit to be level on an irregular floor. The table weighs 44 lb and is equipped with a 30- by 40-inch drafting board. Also included is a detachable tray for drawing instruments.

D-H Associates, 556 W. Monroe St., Chicago, Ill.



Production Engineering Kit 315

An engineering kit for industrial soldering applications is now available for determination of cost savings, using the manufacturer's paste solders, and for determination of the proper paste to be used in hermetic sealing or general-duty production-soldering operations. Partial or full automation of production-soldering operations is possible by using paste solders—a stable combination of pure solder alloys, special fluxes and binders. The test kit enables the research engineer, the process engineer or the production manager to determine with a minimum of time and effort what his potential savings can be. The kit consists of four jars of paste solders, each with a different type of flux. Fluxes range from mild chloride type to strong acid for stainless steels. Each paste incorporates standard 60-percent tin, 40-percent lead solder alloy for test purposes, although any standard or special alloy may be used in the pastes. A plastic hypodermic syringe is included in the kit so that automatic application on the production line may be simulated.

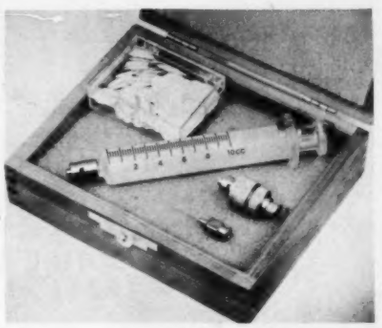
Fusion Engineering, 17921 Roseland Ave., Cleveland 12, Ohio.

Antenna Calculator 316

Covering frequencies from 30 to 30,000 mc, this new calculator was designed to simplify the computations for determining parabolic antenna parameters in microwave antenna systems. The scales include: frequency, wavelength, beamwidth, VSWR, windloading and focal length, as well as spectrum scale for band designation, conversion scales for inches–centimeters and VSWR–return loss. The low-cost calculator will find many uses throughout the microwave industry.

Gabriel Electronics, Div. of Gabriel Co., Main & Pleasant Sts., Millis, Mass.

Fluid Filtration Kit 317



Primarily designed for lab work in ultra-fine filtration and contamination analysis of liquids, the Model SI-13 kit is equally valuable in lubrication applications where a high degree of freedom from contamination is required (for example, critical ball and roller bearings in servo-systems, gyroscopes and tape transports). The kit consists of a 10-cc, precision-ground, glass syringe with a special adapter and 25 membrane filters, which provide effective removal of particles down to 0.25 micron. Fluid volume can be measured directly to 1/10 cc. The filters readily lend themselves to easy microscopic inspection. One 23-gage, 1/2-inch needle is supplied, but other sizes are obtainable if desired.

Bearing Inspection, Inc., Huntington Park, Calif.

'Micarta' Fan Blades Resist Corrosion,

E. J. Stefanides, Central States Editor

Phenolic-impregnated, fabric-based laminate plastic now is being used to make the blades for 14- to 22-ft-dia propeller-type fans for cooling towers. Use of the plastic material provides a mechanically strong, long-lived blade, capable of absorbing vibration and highly resistant to the corrosive factors normally encountered in this service.

Not only the laminated blades, but also the shanks by which they are attached to the steel hub, are made of the material, "Micarta" Grade 262, which the fan manufacturer calls "Hartzite". To minimize losses, the material is supplied to the manufacturer in three special sheet sizes ranging up to 49-1/2 by 108 inches with thicknesses between 0.094 and 0.125 inch.

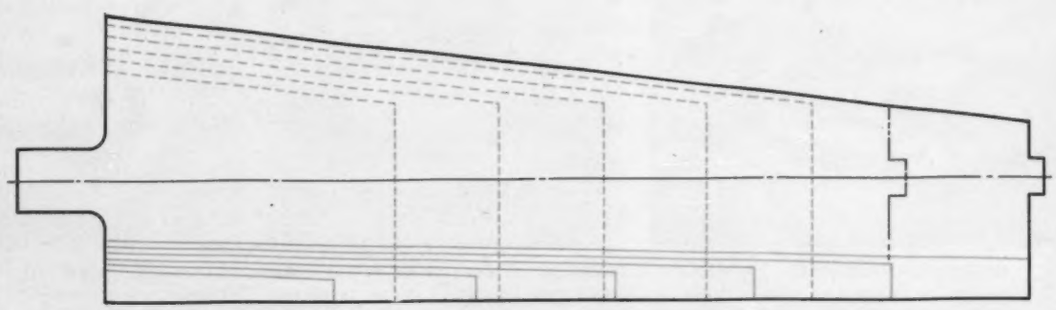
Manufacture starts with cutting of the blade laminations and the laminations for the blade edge reinforcement. Blade laminations then are run successively through rolls which coat the laminations with the phenol-resorcinol-type adhesive. The adhesive bonds the laminations together. Laminations then are positioned in the lower half of a die and each individual lamination is arranged to provide a longitudinal cross-section for efficient cantilever loading. Each blade then is cured in a steam-heated die under pressure for approximately two hours. This thermosetting process permanently molds the blade to the desired contour.

The shank then is added. It consists of two blocks of the laminate which form a clothespin-like assembly that clamps over the hub of the blade. Stainless steel bolts, as well as adhesive bonds, provide the required joint strength. Adhesive then is applied to the blade leading edge, and the leading edge reinforcement laminations are clamped in place.

After further curing, the shank end is turned to the desired diameter in a special lathe fixture and edges of the laminations are smoothed by hand grinding to conform to a template. During grinding, the blades are reduced to a specific weight and are individually statically balanced against a master blade.

The present blade design and method of blade fabrication were evolved following trials of two other methods of fabrication. In the first method the blades were molded of solid sheets of plastic of uniform thickness. This eliminated the corrosion problem; however, the weight distribution was unsatisfactory. Additional strength was achieved by switching to the reinforced laminate, but the corrosion was not completely eliminated until a tapered blade design fabricated by glueing graduated sizes of the laminate was evolved.

These blades and the complete fan assembly in which they are used were designed and are manufactured by the Hartzell Propeller Fan Co., Piqua, Ohio. The "Micarta" material from which they are manufactured is produced by the Micarta Div. of the Westinghouse Electric Corp., Hampton, S. C.



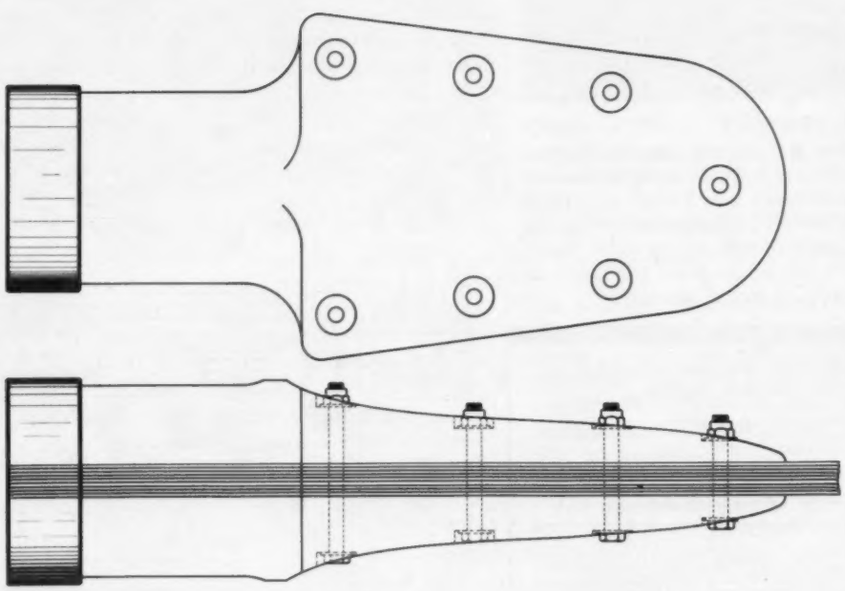
PLAN VIEW OF BLADE shows placing of lamination which provides tapered blade design with bulbous leading edge that gives additional beam strength. Tip tab is used to position blade in fixture for turning of shank diameter, is cut off after turning is completed.

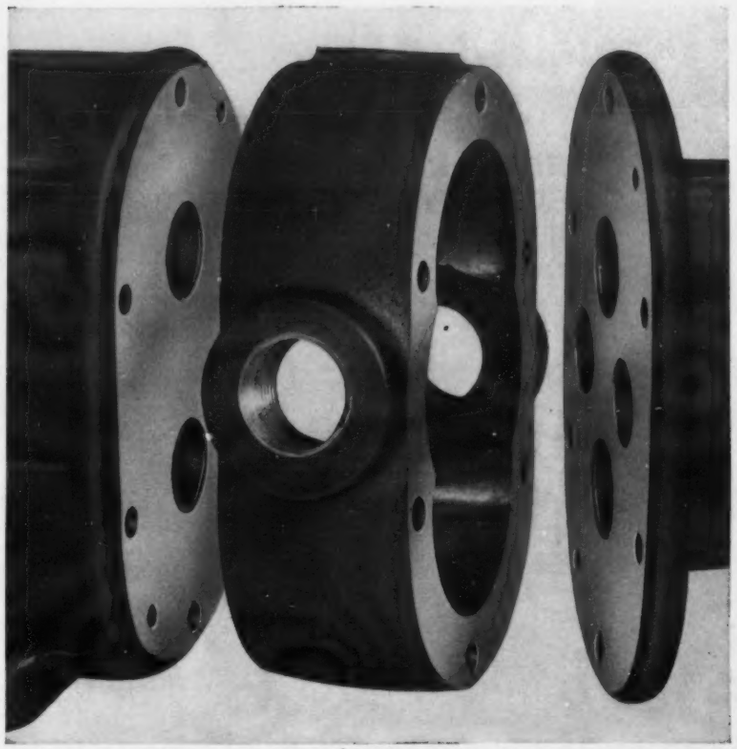
BLADE SHANK is fabricated of laminate blocks, adhesive-bonded and stainless steel—bolted to blade. Shank is turned to provide recessed round section for clamping in hub. Collar on end provides positive restraint against centrifugal force.

Provide Greater Beam Strength

LAMINATED PLASTIC BLADES for cooling tower fans from 14 to 22 ft dia are built up from thin sheets of "Micarta". Fans normally rotate in horizontal plane to drive moisture-laden air upward. Material selection eliminates most corrosion problems, provides blades which are not notch-sensitive and which have good fatigue strength. Fan blades are balanced individually against master blade while welded steel tub is dynamically balanced separately. This procedure provides initial good balance and assures balance after field blade replacement.

BLADE LAMINATIONS are bonded and molded to high camber contour in steam-heated die in hydraulic press.





No padding required! Flat, smooth faces of B&S pump parts mate perfectly, with nothing but a thin coat of shellac in between. Accuracy of clearances is not dependent on choice of gaskets. It is "ground-in" — and stays that way.

Nylon Fuel Regulator Consists

Lars G. Soderholm, Midwest Editor

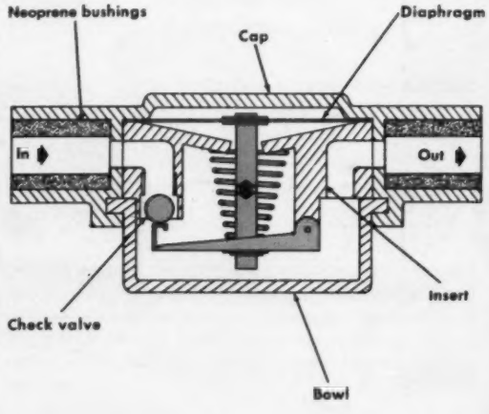
A low-cost plastic automotive-fuel regulator uses precision-molded nylon parts to eliminate machining and finishing operations. A neoprene bushing in each end of the regulator swells in the presence of gasoline and forms its own leakproof seal around the gas line.

Injection-molded polyamide (nylon) components were chosen for this application for several reasons. One reason is the low cost of the unit because of precision-molding techniques in which important dimensions of major parts are held to a tolerance of ±0.002 inch. This eliminates machining and finishing operations necessary with a metal or combination glass and metal regulator. Another reason why nylon works well in this application is its resistance to gasoline and the high temperatures found in the engine compartment.

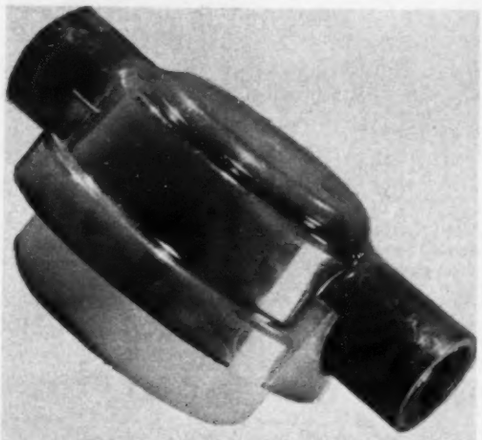
Light weight of the plastic results in a fuel regulator with a total weight of only 2 oz. This reduces the fastening problem and eliminates metal clamps and fittings that are necessary with heavier units.

To install the fuel regulator it is necessary to cut out 2-1/8 inches of the gas line. The ends of the gas line then are inserted in the neoprene bushings at each end of the regulator. Gasoline, which serves as a plasticizer for neoprene, makes the bushings swell and form a tight, leakproof seal between the regulator and the gas line.

The function of the pressure regulator is to control the pressure at which gasoline enters the



of Precision-Molded Parts



carburetor of the car. It operates on the ball-check principle using a steel ball and a brass seat. A calibrated steel spring controls the fuel pressure at 3-1/2 psi. This low constant pressure, according to the manufacturer, conserves fuel and promotes smoother engine performance.

The "Miser Mite" plastic fuel regulator is molded by Artag Plastic Corp., Chicago, Ill., for Milemaster, Inc. of America, Exeland, Wis.

DESIGN DATA NEWS

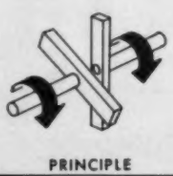
Magnetic Drives

R. H. Warring, Beckenham, Kent, England.

Design and performance characteristics of three standard forms of magnetic drives utilizing permanent magnets are summarized in this article. Among advantages of magnetic drives are: high efficiency, elimination of mechanical linkages and high reliability. The follower drive, in particular, can operate with a relatively large air gap so that the drive may be transmitted through a partition or wall, eliminating glands or packings associated with mechanical drives in such applications.

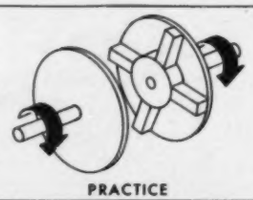
Design is largely empirical, with no set formulas for specific power requirements. Suitable sizes and numbers of magnets required are best established by "cut and try" methods with consideration for the overall design problem. After a test model has been evaluated, it is then a relatively simple matter to interpolate or extrapolate data to arrive at a final design. Performance data is assessed largely on unit drag obtained with magnet pairs or magnet poles, utilizing high-energy permanent-magnet materials.

Follower Drives



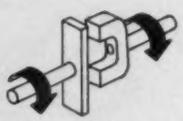
PRINCIPLE

Principle embodies one or more pairs of magnets suitably mounted with an air gap. One magnet (or set of magnet pairs) is at right angles to the axis of the driving shaft and one magnet (or set of magnet pairs) is at right angles to the driven shaft.



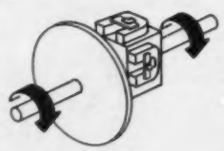
PRACTICE

Eddy-Current Drives



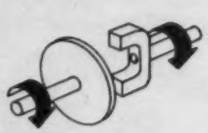
PRINCIPLE

Principle of the eddy-current drive embodies a permanent magnet rotating close to a conducting metal plate. The drive is asynchronous. Torque is zero with no slip and increases with increasing slip. The drive is self-starting and can be designed to carry overloads. Eddy currents generated in the driven disc are responsible for heat losses and hence the drive can never achieve 100 percent efficiency. Satisfactory high efficiencies can be achieved, however, by careful design.



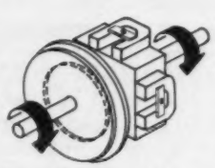
PRACTICE

Hysteresis Drives



PRINCIPLE

The hysteresis drive combines the synchronous characteristics of a follower drive up to the point of maximum synchronous torque. At this point, slip takes place and torque capacity is increased further by eddy-current effects. It is a self-starting drive against full load within the loading limits given by the eddy-current components, the value of which is largely governed by the rotor disc material characteristics. Full torque can be developed at very low speeds and either the magnet or the hysteresis disc can be made the driving element. The permanent-magnet unit can be replaced by an a-c winding or rotating a-c winding to produce a hysteresis motor.

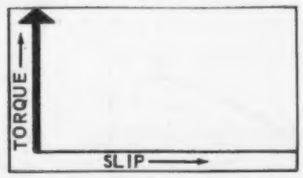


PRACTICE

Magnetic Drives

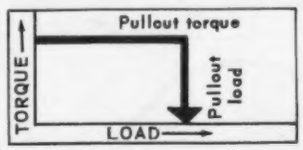
Torque-Slip

Torque is transmitted without slip. Slip can occur only when pull-out torque is exceeded. When slipping, drive is disengaged completely and no torque is transmitted. Drive must be stopped or slowed to re-engage. Because torque transmission is only possible without slip, drive is 100 percent efficient.



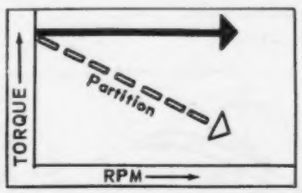
Torque-Load

Full pull-out torque is available with increasing load up to point where load exceeds this maximum torque value. Drive remains fully synchronous over this range. Once pull-out torque is exceeded, drive disengages and assumes 100 percent slip with driven member braked to a standstill by the load.



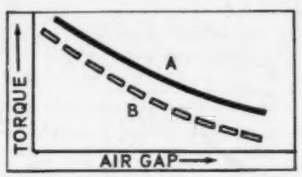
Torque-RPM

Full torque up to pull-out value is available at all speeds and independent of speed. Where drive operates through nonmagnetic partition, there is progressive loss of torque with increasing rpm resulting from eddy currents generated in wall. These currents also represent a power loss so that under these conditions efficiency is reduced.



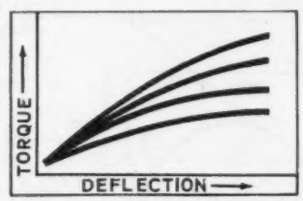
Torque-Air Gap

Characteristic reduction of torque with increasing air gap is given by the typical curve A. Effective torque, in practice, may be lowered to curve B by demagnetization (example, by opposition of the magnet poles). Normal precautions should be taken to avoid magnetic damage during assembly and use of drive.



Torque-Deflection

Increasing torque produces increasing angle of deflection between driving and driven magnet pairs over relatively small range (10 to 15 deg) up to pull-out torque. For constant torque, deflection is constant and input rpm equals output rpm. Drive will follow fluctuating torques within pull-out range synchronously with varying deflection.



Unit Drag-Air Gap

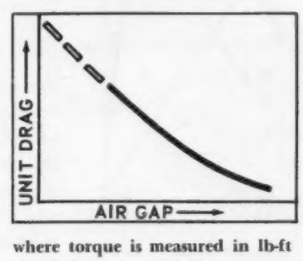
Unit drag per magnet pair decreases with air gap in characteristic manner shown. If D = unit drag/magnet pair, R = mean radius of magnets, N = number of magnet pairs and S = rpm:

Torque = (D)(R)(N)

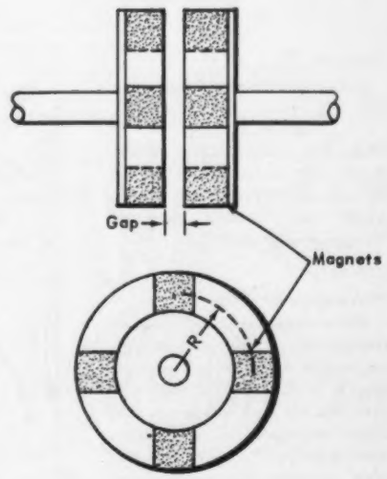
Horsepower of the drive then follows:

HP = (D)(R)(N)(S)/5250

where torque is measured in lb-ft and R is measured in ft.



Follower Drives



Design Tips

Cylindrical permanent magnets are suitable for small low-power drives. Larger drives are best made by assembling pairs of magnets on a suitable plate to give two similar units, one for the driving member and one for the driven member.

Direction of magnetization of the two members should be opposite.

For maximum performance, driving and driven units should be magnetized as complete assemblies.

Any number of magnet pairs can be used, subject to the geometry of the drive.

Standard high-energy permanent-magnet alloys should be used for follower drives. Performance will be specific to alloy chosen, but general characteristics for all materials will follow the pattern described.

Thrust bearings should be provided to carry the axial load induced by magnetic attraction.

Air gap should be reduced to a practical minimum for maximum torque output.

Where an intervening metallic partition is used, wall material should have a high specific resistance to minimize eddy current losses. Consideration also must be given to heating effects of the generated eddy currents which may cause buckling.

(Continued on next page)

Magnetic Drives . . .

Torque-Slip

Torque increases with increasing slip. Slip velocity is defined as:

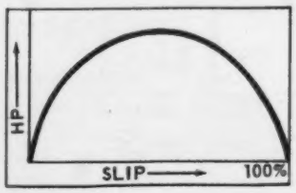
$$2\pi R(S_{in}-S_{out})$$

where R = mean radius of magnet poles. It is immaterial which of the two units is made "driver" and which the "driven" member. Torque is calculated:

(drag/magnet)(N)(R) in appropriate units.

Horsepower-Slip

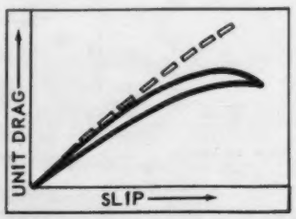
Power output is proportional to (torque) (S_{driven}) and shows a typical peak at a specific slip velocity, usually of the order of 40-50 percent slip. For a given slip velocity, power output can be increased by making output rpm as high as possible (example, by running the drive at high speed). If necessary,



input shaft can be geared up and output shaft geared down.

Unit Drag-Slip

The theoretical performance (dotted line) is linear, but in practice unit drag falls off at high values of slip. This action is caused by strong eddy currents which cause temporary weakening of magnets. There is also initial loss when drive is first operated and magnets are stabilized. Performance is also slightly different when



slip velocity is increasing and decreasing, yielding hysteresis loop.

Heat Losses—Slip

Heat losses increase with slip and represent increasing power loss which is responsible for "peaking" of horsepower output curve. Power loss is directly proportional to (unit drag/magnet) (N) (slip velocity), and takes form shown because of non-linear characteris-

tics of the practical unit drag-slip curve.

Overall—Slip

Design point for a suitable high-efficiency eddy-current drive normally would be established on rising part of power curve so that slip velocity is low. In addition, reserve of power is available to accommodate temporary overloading or weakening of magnets in service. It should be noted that any weakening of the magnets will cause drive to operate at a lower efficiency.

Efficiency = S_{out}/S_{in}

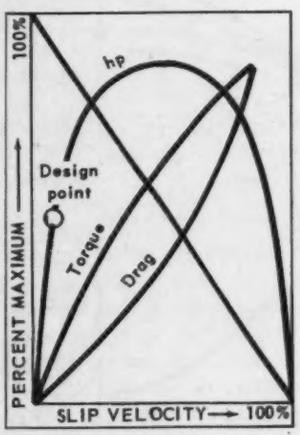
Power absorbed by drive
= (unit drag)(N)$(2\pi R)(S_{in})$/33,000

Power output
=(unit drag)(N)$(2\pi R)(S_{out})$/33,000

Input velocity = $(2\pi R)(S_{in})$

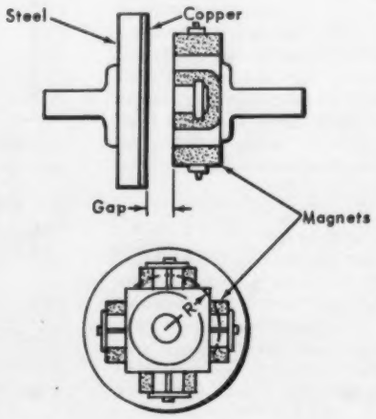
Output velocity = $(2\pi R)(S_{out})$

where N = number of magnets,



R = mean radius of magnet poles and S = rpm.

Eddy Current Drives



Design Tips

High-energy magnets are essential for high efficiency because output is proportional to the square of the magnet strength.

Disc material preferably should be mild steel faced with a copper layer. The majority of eddy currents is produced in the copper. The steel provides rigidity and a good flux path.

A small air gap is essential for maximum performance. Adjustment of the gap, however, does allow the capacity of the drive to be varied. This provision, if required, can be incorporated in the design, either for static adjustment or adjustment with the drive actually running.

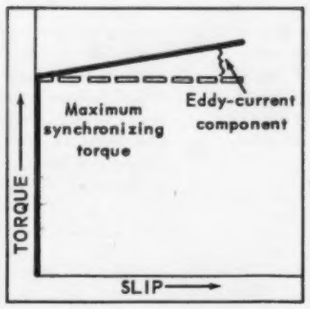
Magnets can be stabilized before assembly (example, by open-circuiting) to arrive at a consistent performance. Drive output will then be approximately 20-30 percent lower than for magnets magnetized in place or assembled in such a way that the magnetic circuit is never broken.

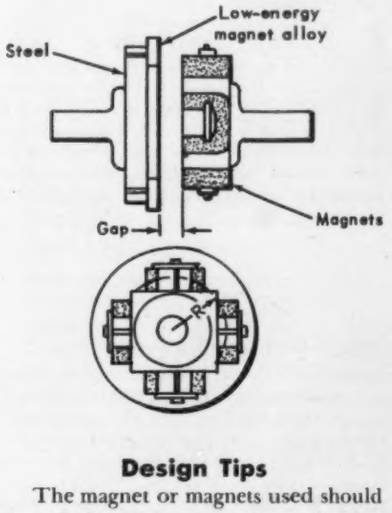
Temperature rise in the disc may be appreciable with higher slip velocities. Thus, the design point should always aim at low slip velocities, increasing the size of the drive or number of the magnets, if necessary. The thickness of the copper facing is not critical. A thicker layer is helpful with a larger air gap because it tends to increase eddy-current strength. A maximum thickness of 0.1 inch is generally satisfactory for most applications.

Magnetic Drives . . . Hysteresis Drives

Torque-Slip

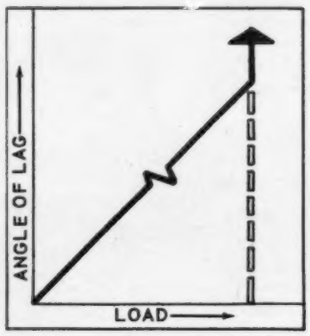
Within capacity of hysteresis torque, drive remains fully synchronous with no slip. When maximum synchronous torque is exceeded, slip takes place with hysteresis torque maintained at constant (maximum) value. Eddy currents then are produced in hysteresis disc proportional to slip velocity. This action increases capacity of the drive. Power losses when running under hysteresis drive conditions are caused by friction and windage only. When slipping, there is additional power loss resulting from heating, proportional to square of slip velocity.





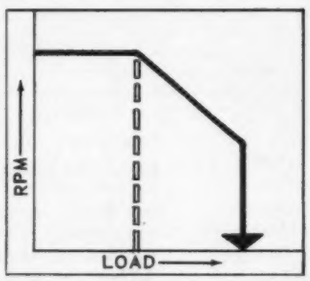
Angle of Lag-Load

Within range of maximum hysteresis torque, running is synchronous with angle of lag between driving and driven elements, which increases with load. Sudden load fluctuations which induce momentary slip are damped by resulting eddy currents so that drive rapidly assumes synchronous running. Relative displacement of magnet poles is responsible for asymmetric magnetization of hysteresis disc which yields the torque. When limiting load is reached and disc slips, its material is subjected to hysteresis cycles.



RPM-Load

Output speed equals input speed up to maximum synchronous torque developed by hysteresis. Torque output within this range is independent of speed. In this respect, hysteresis drive is operating with essentially same characteristics as follower drive. When limiting load is reached, slip starts and output speed falls with increasing load up to stall point.



Design Tips

The magnet or magnets used should be of the high-energy type. An isotropic permanent-magnet material is necessary for the hysteresis disc and a material with a weak peak field strength generally gives best performance because it is more readily fully magnetized. High-torque drives normally would employ an Alnico V magnet and a cobalt steel permanent-magnet alloy (unmagnetized) for the hysteresis disc.

Low-torque hysteresis drives can employ an Alnico II magnet with a low cobalt steel or chromium steel hysteresis disc. Eddy-current characteristics of the drive can be improved with a copper layer on the hysteresis disc, if this part of the drive is to be utilized.

Tempering the hysteresis disc material also increases the eddy-current losses and hence enhances the eddy-current torque which is generated with slip. Eddy-current characteristics also can be varied by varying the hysteresis disc material on a "cut and try" basis.

Calculation of Theoretical Torque

Theoretical hysteresis torque can only be calculated by assuming small amount of slip:

Torque per magnet $= AV/8\pi^2 g$

where A = area enclosed by hysteresis loop of disc material under working conditions and V = volume of disc material. It is most convenient to use cgs units: A in gauss-oersteds, V in cu cm and $g = 981$ cm/sec^2. Torque is then in gm-cm.

The eddy-current torque produced by slip cannot be calculated on theoretical lines since this depends on disc material and its state, but can be expressed as:

Eddy-current torque = (C) (slip velocity)

where C = empirical constant.

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Circuit-Breaker Selector Disc 451

Can be used to identify requirements from six basic types of breakers. By rotating and matching top and bottom sections of the 7-inch dia disc, both physical and electrical characteristics of breakers in various types and sizes can be determined. Depth, width, height and number of poles can be read, as well as maximum amperage and voltage, and interrupting ratings for varying a-c and d-c voltages. Westinghouse Electric Corp., Standard Control Div., Beaver, Pa.

India's Economic Development 452

An 18-page review of economic steps that have taken place in India during the past two Five-Year Plans, as she heads into her third Five-Year Plan. Questions about the economic aspects of the Third Plan are raised and answered such as: What does the Third Plan propose to accomplish? To what extent will India pay for the Third Plan from her own resources? To what extent does she have the resources to meet her portion of the total costs? To what extent does she need a critical margin of outside help during the next few years? Information Service of India, 2342 Massachusetts Ave., N.W., Washington 8, D.C.

Microminiature Taps Standards 453

New Government standards "National Miniature", for microminiature taps, dies and gages. "OOC" precision taps, dies and gages for work with miniature screws also are described. A price list for "OOC" sets of taps, dies and gages and accessory items is included. R. P. Gallien & Son, 220 W. Fifth St., Los Angeles 13, Calif.

Pot Failures 454

A refreshingly different approach on "How to Solve Pot Failure Problems" presents some novel "fixes" to the engineer when pot failures occur. Fully illustrated are some funny, yet logical, solutions to familiar pot problems. Printed on heavy stock, opening up to a full 18 by 21 inches, the literature provides four large cartoon "solutions", each suitable for framing. For engineers and executives who would like to add a chuckle or two to their daily grind. Computer Instruments Corp., 92 Madison Ave., Hempstead, L.I., N.Y.

Adjustable V-Belt Chart 455

All steps in the installation of "Veelos" adjustable V-belts are illustrated on a 17-1/2- by 21-3/4-inch wall chart. Included on the chart are comparative length tables listing "Veelos" lengths in inches for equivalent sizes of fractional-horsepower endless V-belts, sizes 3L140 through 5L1000, and for industrial endless V-belts, sizes A26 through E660. Directions are given for measuring, coupling, uncoupling and installing the belts on drives. Manheim Mfg. & Belting Co., Manheim, Pa.

Re-entry and Recovery 456

"Progress in Re-entry-Recovery Vehicle Development" is a complete history of the company's re-entry vehicle development. The 33-page illustrated article provides a cross-section of the nation's space programs from first Air Force ICBM and IRBM systems, satellite re-entry and recovery, and scientific space probes to manned space vehicle activities. Designated PIB-A11A, the brochure includes progress in re-entry and recovery technology, a summary of historic achievements and a glimpse at the future of the vehicles. General Electric Co., Missile & Space Vehicle Dept., 3198 Chestnut St., Philadelphia 1, Pa.

Automatic Tire Inflator 457

An inflator to fill any device to a preset pressure and to shut off automatically is described in four-page Bulletin NP-800E. One style for passenger tires and another for truck, bus or airplane tires are illustrated. Accessories for the inflators are pictured. A price list for the units and accessories is included. OPW-Jordan Corp., 6013 Wiehe Rd., Cincinnati 13, Ohio.

Plastic Data Sheets 458

A series of plastic data sheets covers nine of the most widely used thermoplastic materials. Each file-sized bulletin contains a brief description of the subject plastic and its typical uses, as well as specifications of physical, electrical and chemical-resistance characteristics. Sizes, forms (sheets, profiles or tubing) and colors in which the material can be furnished are shown. Materials covered include elastomeric vinyl, rigid polyvinyl chloride, polyethylene, polypropylene, styrene, butyrate and nylon. Conneaut Rubber and Plastics Co., Commerce St., Conneaut, Ohio.

Emergency Lighting 459

Shows what happens in a power failure "blackout" and how the risks can be avoided by property owners. "The Odds on Emergency Lighting", 12 pages, covers the probability and costs involved in power failure, as well as information and specifications on Light Warden battery-operated emergency lighting. Typical installation diagrams and approximate costs are included. Electric Cord Co., 432 Plane St., Newark 2, N.J.

Daylight-Saving Time Guide 460

A handy guide to time-zone and daylight-saving time differences in the U. S. The time map measures 8-1/2 by 7-1/4, suitable for under a desk glass or on a bulletin board. States using daylight-saving time are shown at a glance as well as the states in which most cities of 25,000 population or over use daylight-saving time. U. S. Industrial Chemicals Co., Div. of National Distillers and Chemical Corp., 99 Park Ave., New York 16, N.Y.

Rotary Solenoid Applications 461

Three thought stimulators for the engineer interested in designing for compactness through the use of rotary solenoids. The one-page leaflet contains line sketches illustrating solenoids being used for cutting, sorting and hole punching. Accompanying the leaflet is a letter with additional sketches illustrating rotary solenoid application benefits. Ledex, Inc., 123 Webster St., Dayton, Ohio.

Breakers, Switches Comparison Guide 462

Circuit breakers or safety switches? A 32-page pocket comparison guide provides costs, sizes, installation and other features of both. Advantages of AB-1 circuit breakers, including reduced cost, space and maintenance are highlighted, and safety, operator control, light weight, attachment and stock flexibility features are reviewed. Westinghouse Electric Corp., Standard Control Div., Beaver, Pa.

Flexible Cushion Couplings 463

Absorb vibration and compensate for all combinations of shaft misalignment and end float. Bulletin 901B, 24 pages, illustrates the new PX280 coupling with more than twice the torque capacity of the next smaller size, and PX90, an intermediate size. Illustrations, engineering drawings and installation pictures are given for the products as well as descriptions of standard, high-speed and fly-wheel types. Dodge Mfg. Corp., 300 Union St., Mishawaka, Ind.

Component Holders 464

Typical configurations and characteristics of a complete line of component holders. The 64-page catalog furnishes a material selection guide and a part-numbering code. Tables of dimensions are provided for 35 different types of holders. Sketch and dimension sheets are included for ordering ease. Masterite Industries, 839 W. Olive St., Inglewood, Calif.

Cemented Carbide Products 465

A simplified Practice Recommendation No. R263-60 lists standard stock items of the cemented carbide industry. Issued by the Commodity Standards Div., Office of Technical Services, U.S. Dept. of Commerce, the document covers 44 items which are most popular in industry such as throw-away carbide inserts, saw tips, chisel blanks, die nibs, masonry drills and twist drill blanks. Each of the listings for the standard stock items is broken down according to the grade of carbide. A uniform system of identification of products also is described. One section of the 38-page publication deals with nomenclature and definitions of interest to anyone concerned with cemented carbides. Cemented Carbide Producers Assn., 2130 Keith Bldg., Cleveland 15, Ohio.

Selecting Solenoid Valves 466

A study of solenoid valve selection for corrosive applications. Catalog Manual No. 108, 16 pages, includes a discussion of solenoid valve constructions, a list of more than 500 corrosive chemicals commonly used in industry, seven pages of valve selection charts, diagrams showing normally closed and normally opened configurations, a glow-versus-pressure-drop chart and general information. Valcor Engineering Corp., 365 Carnegie Ave., Kenilworth, N.J.

Maintenance and Repair Parts 467

"One Way to Make Your Job a Little Easier" contains helpful facts of interest to maintenance executives, engineers and other key maintenance personnel. The 16-page Bulletin No. 24 offers solutions for those faced with the problem of getting machinery repaired and back into production quickly and at minimum cost. The graphic photo-caption format offers ideas on how to save time on machining parts, eliminate heat treating, quench cracks and last-minute parts rejections. Suggestions are made for avoiding secondary operations such as cleaning, straightening, finish grinding and inspections. La Salle Steel Co., Box 6800-A, Chicago 80, Ill.

Miniature Pushbuttons 468

Revised Bulletin GEA-7127A, 12 pages, includes new forms added to a complete line of industrial, miniature, oiltight pushbuttons. A four-color photograph shows many color combinations and the added flexibility now available. Diagrams and photographs show the 40 percent space savings realized in enclosures or panels by use of miniature forms. Cutaway drawings depict features such as pressure-type terminals, double-break contacts and multiple oil-seals. General Electric Co., Schenectady 5, New York.

Pump Motors and Drives 469

Data on an entire line of motors and drives in the pumping field. The 20-page Form F-2002 is indexed so that motors and drives may be identified as to construction type (solid-shaft, hollow-shaft, submersive, horizontal, close-coupled, right-angle geared drives, extended-base and NEMA base); as to enclosure (weather-protected, dripproof, totally enclosed, explosionproof, sealed and weatherproof); as to thrust (high, medium, normal) and as to type designation. U. S. Electrical Motors, Inc., Box 2058 Terminal Annex, Los Angeles 54, Calif.

Open-End Wrenches 470

Describes a new principle in wrenches and shows how the new "Wrenchking" open-end wrench provides true ratchet action and positive grip power. Four-page Bulletin 770 provides questions and answers on the wrenches such as the amount of torque delivered, guarantee and strength. Available in single units, or in a set of five different sizes, the "Wrenchking" is manufactured by Royal Tools, Inc. The Bristol Co., Socket Screw Div., Waterbury 20, Conn.

TECHNICAL PAPERS

Copies of these papers may be obtained by writing to technical society indicated. Addresses follow last item.

COST MODELS FOR CONTROL SYSTEMS ENGINEERING; *Harold Chestnut, General Electric Co., Schenectady, N. Y.; AIEE No. CP61-707; $1; to AIEE members, $0.50.*

The use of cost model relationships is effective in determining significant economic factors in connection with control systems. Long-, medium- and short-term cost models are reviewed. Development of detailed, mathematical cost equations will depend on the particular cost figures for the specific job under consideration, once the literal terms have been determined.

APPLICATIONS AND LIMITATIONS OF NEW DEVELOPMENTS IN METALS JOINING PROCESSES; *P. J. Rieppel, Battelle Memorial Institute, Columbus, Ohio; SAE No. 160B; $1; to SAE members, $0.75.*

Some of the developments in the metals-joining field and applications and limitations of new processes. In the fusion welding area, processes include electro-slag welding, short and dip-arc welding, short-arc process, dip-arc process, short-arc and dip-arc process, electron-beam welding and arc-spot welding. In the resistance welding area, processes include high-frequency welding, foil-seam welding and magnetic-force welding. In the solid-state area, processes include ultrasonic welding, friction welding, diffusion bonding and explosive welding.

IMPACT OF RECENT DEVELOPMENTS IN HIGH-STRENGTH STEELS ON STRUCTURAL DESIGN AND FABRICATION; *R. H. Marvin, The Budd Co., Space Atomics Sec., Philadelphia, Pa.; ASME No. 61-MD-8; $1; to ASME members, $0.50.*

The true measure of the usefulness of high-strength materials is best evaluated in a fabricated structure in which all characteristics of the material are integrated. Several examples of structures designed and fabricated in strain-hardening and precipitation hardenable steels are discussed. Examples include structures designed principally for compressive loading and structures designed primarily for tensile loading.

OPTIMIZED SNAP III POWER GENERATOR DESIGN FOR SPACECRAFT; *H. H. Greenfield, Lockheed Aircraft Corp., Missiles and Space Div., Sunnyvale, Calif.; ARS No. 1278-60.*

Design performance studies on the original SNAP III type of thermoelectric generator were made to optimize its use as a power system for special spacecraft missions. It was determined that the initial available electrical power can be increased by up to a factor of four. The modification to the SNAP generator consists of increasing the diameter of the thermoelectric elements and decreasing their lengths as well as modifying the fuel container and hot shoes to accommodate physically the thermoelectric element.

A GRAPHICAL METHOD FOR FINDING THE FREQUENCY RESPONSE OF NONLINEAR CLOSED-LOOP SYSTEMS; *A. S. McAllister, Ithaca, N. Y.; AIEE No. 61-710; $1; to AIEE members, $0.50.*

A graphical procedure for finding the frequency response of a large class of systems for which the describing function provides an adequate representation for the nonlinear elements. Attention is restricted to frequency-insensitive, zero-memory nonlinear elements. The method is direct and can be extended to cover systems containing more than one nonlinear element.

A COMPARISON OF COMPUTERS; *Frank G. Curl, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.; AIEE No. 61-725; $1; to AIEE members, $0.50.*

A routine simulating the operation of an analog computer was constructed for use on a digital computer. This code, called DEPI as an abbreviation for "differential equations pseudo-code interpreter", provides much of the flexibility and ease of operation associated with analog computer operation. A study was made in which speed, accuracy and flexibility of the DEPI system were compared with those attributes in a digital differential analyzer, an analog computer and a digital computer.

OPERATIONS RESEARCH ON DRIVER BEHAVIOR; *Fletcher N. Platt, Ford Motor Co., Dearborn, Mich.; SAE No. 319B; $1; to SAE members, $0.75.*

A study of driver behavior giving full consideration to the effects of vehicle and environment. A probability theory of driver behavior related to actual driving practice. The theory is based on the probability of situations occurring in a logical sequence. Experiments are under way to relate quantitative values of a driver's actions to subjective driver ratings, his driving experience, violation record and accident record.

NONROTATING JOURNAL BEARINGS UNDER SINUSOIDAL LOADS; *R. M. Phelan, Assoc. Prof. of Mechanical Engrg., Sibley School of Mechanical Engineering, Cornell University, Ithaca, N. Y.; ASME No. 61-LUBS-6; $1; to ASME members, $0.50.*

Results of experimental investigations of the operational characteristics of journal bearings, when carrying a sinusoidal load with zero angular velocity for both journal and bearing. Deficiencies of analytical solutions are noted with respect to effects of oil film, adequacy of oil supply, clearance ratio and assumed leakage path. Also discussed is the possibility of predicting the behavior of a statically loaded ordinary journal bearing, when subjected to an additional suddenly applied load.

SOME STRESS RUPTURE PROPERTIES OF COLUMBIUM, MOLYBDENUM, TANTALUM AND TUNGSTEN METALS AND ALLOYS BETWEEN 2400-5000F; *A. Donlevy and J. K. Y. Hum, Stauffer Metals Co.; SAE No. 354D; $1; to SAE members, $0.75.*

How electron beam heating can be used as a heat source in stress rupture testing of refractory metals and their alloys. Temperatures from 2400F to above the melting points can be obtained by this mode of heating. Results obtained from a stress rupture unit were fairly consistent. There is good probability that the uniformity of the material produced by electron beam melting is one of the reasons for the uniformity of the data.

American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.
American Rocket Society, 500 Fifth Ave., New York 36, N. Y.
The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.
Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

DESIGN IDEAS NEWS

CONTROLS

Venturi Section Gives Valve Internal

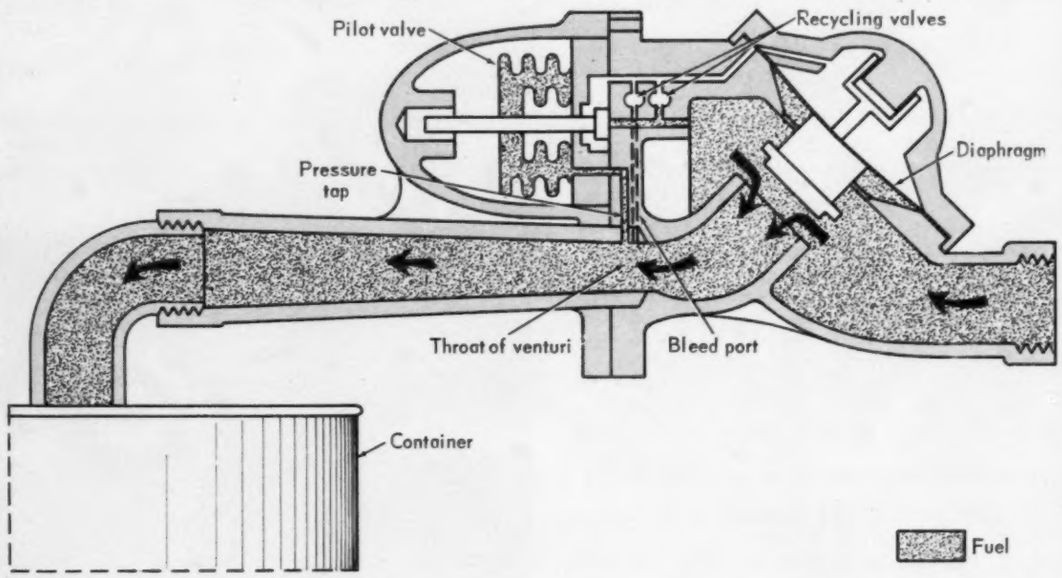
Pilot Connection to Venturi Throat Measures Pressure Inside Container

Lars G. Soderholm, Midwest Editor

A pressure shut-off valve, used in filling collapsible containers, uses a venturi section to duplicate the internal pressure of the container being filled. Pressure at the throat of the venturi is used to actuate a pilot valve which at a preset pressure closes a diaphragm valve to block the fuel line.

The shut-off valve was designed to fill nonvented, collapsible containers used by the military in storing and transporting fuel. Each container measures approximately 4 ft in dia by 6-3/4 ft long and has a 525-gal capacity. A single opening is used in filling these containers. At a pressure of about 5 psig, the fuel flow is automatically cut off. At this pressure there are about 495 gal of fuel in the container with the remaining space being filled with air.

One of the problems in the design of this valve



PRESSURE DIAGRAM shows how pressure rise in venturi is made to equal pressure drop through container fitting.

Pressure Reference Point

to Regulate Flow Cutoff

was that of measuring the internal pressure of the container as it was being filled. An external connection would have made the unit more complicated and also more susceptible to damage.

The solution to this problem came when it was found that a venturi section in the shut-off valve body could provide a pressure gain equal to the pressure loss through the fill fitting in the container. In this manner the pressure inside the container can be detected by internal porting from the throat of the venturi.

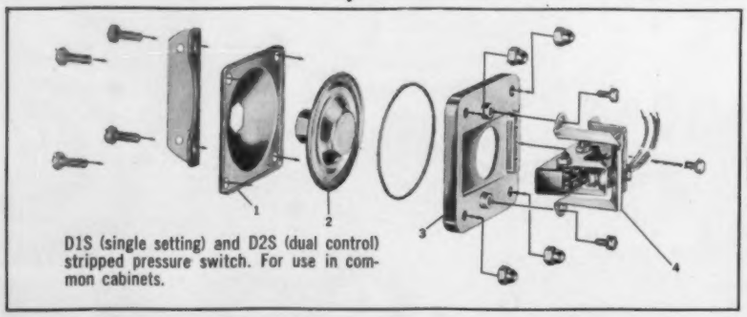
The pilot valve is actuated by a set of double bellows with a valve plunger attached to the free end. As the container pressure (detected at the venturi) builds up, the bellows finally overcomes its resistance and unseats the plunger from the valve passage opening. This allows fluid flow into the cover behind the reinforced synthetic diaphragm which forces a poppet into the main flow valve seat.

Two 2-way recycling valves located in the valve body casting provide a means of draining the fluid from behind the diaphragm after the valve has shut off and also a means of closing the valve at any time. The start valve permits the fluid in the cover to drain through a bleed port into the venturi section. This removes pressure behind the diaphragm and allows the main valve to open again. The stop valve bypasses the pilot valve and permits an immediate stop of the main fluid flow.

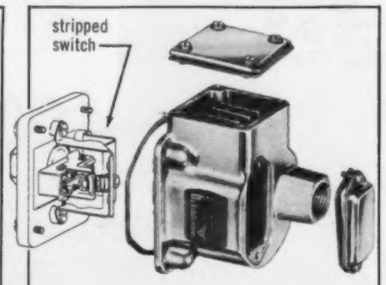
The valve body is made of tempered aluminum castings and weighs about 12 lb. It can handle up to 100 gpm.

The valve was designed for the Quartermaster Research and Engineering Command, Natick, Mass., at the Armour Research Foundation of the Illinois Institute of Technology, Chicago, Ill.

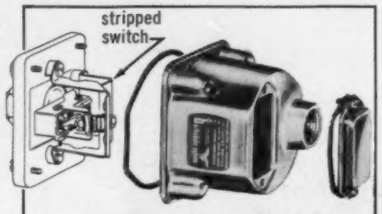
How to put 50% more accuracy into a pressure switch at 25% lower price



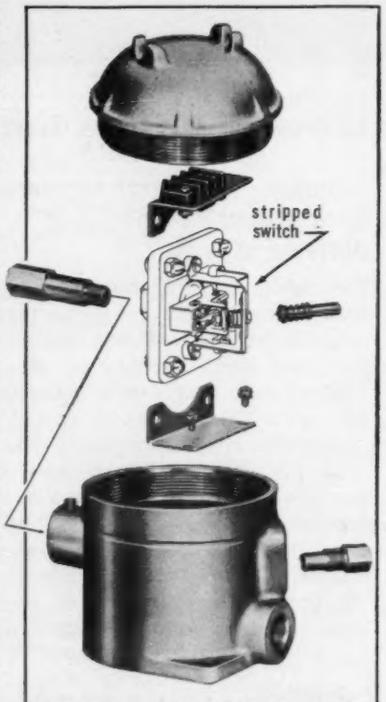
D1S (single setting) and D2S (dual control) stripped pressure switch. For use in common cabinets.



D1T (single setting) pressure switch with integral terminal block. Weatherproof housing.



D1H (single setting) and D2H (dual control) pressure switch with standard housing. Weatherproof.



D1X (single setting) and D2X (dual control) explosion proof pressure switch. Pottable electric outlets. External adjustment.

The accepted standard of accuracy in pressure switches is ±1%. The new Barksdale diaphragm pressure switches are guaranteed for ± ½ % set and re-set accuracy (±0.2% if required). This instrument accuracy, unique proof (test) pressure characteristics, and remarkably easy servicing are accomplished by the use of a "basic unit" diaphragm assembly to which components are attached as required. The erector set principle permits production economies that are reflected in substantially lower prices. The entire concept of Barksdale pressure switches is the result of desired specification improvements as suggested by representatives of varied industries who were consulted before designing was begun.

The versatile basic unit

A leakproof, welded-metal sensing element (No. 2 in the photograph above) is surrounded by a heavy protective capsule (Nos. 1 and 3) which is independent of the sensing and switching elements. The hex of the pressure connection fits into a hex opening in the base of the capsule, preventing damage to the diaphragm should the unit be twisted during installation or removal. The standard pressure connection is ¼" npt female pipe fitting; ½" npt fitting is available when specified. The latter was requested by the petroleum industry to facilitate removal of paraffin accumulation and to permit attachment of switches directly to ½" pipe.

Diaphragms easily removable

Diaphragms may be removed without disturbing switch wiring, thus making it possible to change diaphragms to accommodate varying pressure requirements or to substitute diaphragms of different metals as fluid characteristics may demand. This feature cuts inventory costs for original equipment manufacturers because they need stock only diaphragms to meet their various pressure requirements rather than to stock complete switches in every category. It is important, also, to the petroleum industry because only diaphragms (not entire switches) need be carried by personnel doing field service.

Proof (test) pressures to 300 psi

The upper and lower sections of the diaphragm capsule are molded to fit the sensing element exactly. The top section prevents the diaphragm from stretching beyond normal curvature when surges above system pressure are encountered, and there is no possibility of metal distortion that would affect switch accuracy. In the low settings the new Barksdale pressure switches will actuate at 0.1" mercury with proof (test) pressure to 10 psi. In higher ranges they will go up to 300 psi proof (test) pressure at settings to 150 psi.

Stripped switch (single and dual control)

Addition of a switching element (No. 4 above) to the basic diaphragm unit makes a stripped switch for use in a common cabinet with other electrical devices. Original equipment manufacturers need not pay for unneeded housings. Extremely fine adjustment is possible because the adjusting screws have 64 threads to the inch. Adjustment may be made with a screwdriver or a wrench.

Housings added to suit

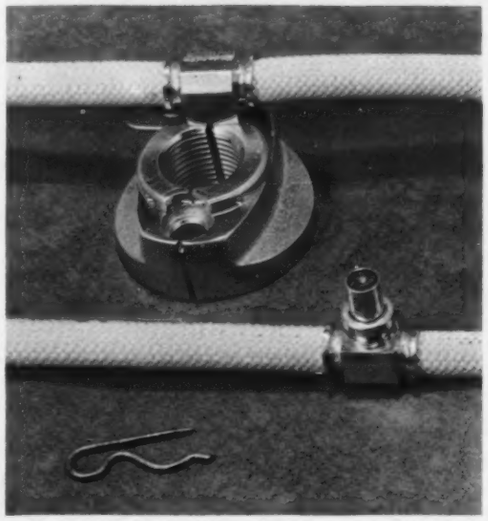
Addition of a sealed housing (standard, terminal block, or explosion proof) to a stripped switch completes a pressure switch that can be ordered "tailor made" for any desired application. In the standard housing, free wire leads are through a ½" nps conduit conductor. Wires are held firmly in place by a special tension clip that prevents disturbing the switch adjustment through careless wire handling. Terminal block housings are available for wiring convenience. Pottable electric outlets and external adjustment on explosion proof housings were suggested by the petroleum industry. Servicing instructions on all Barksdale switch housing are on the inside of a tamper proof cover to allow for painting of units.

Ask for new catalog

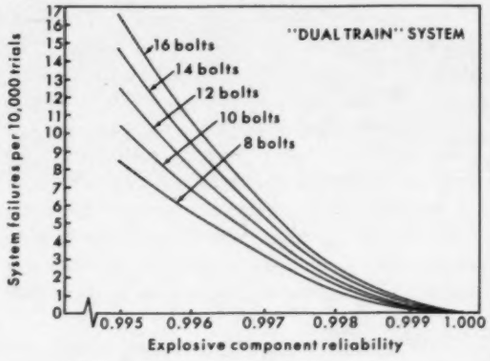
New Barksdale diaphragm pressure switches offer you something new in accuracy, proof (test) pressure, and economy. The just-printed catalog tells the complete story. Ask your Barksdale representative or write to Barksdale Valves, 5125 Alcoa Avenue, Los Angeles 58, California.

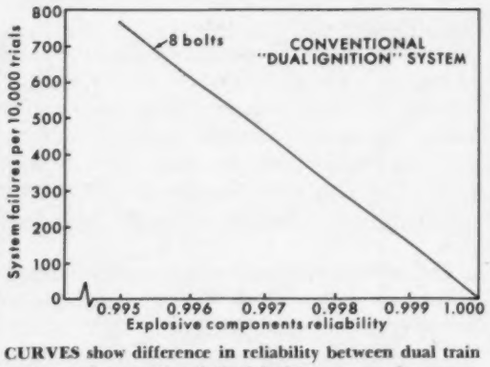
Circle 43 on Reader-Service Card for more information

Frangible Nuts Improve Stage



FRANGIBLE NUT parts at stress concentration grooves. Either or both burst charges may fracture nut.





CURVES show difference in reliability between dual train system and conventional dual ignition system for separation system failure rates versus explosive component reliability. Dual train system approaches 0.999 reliability factor for eight-bolt system.

Separation System Reliability

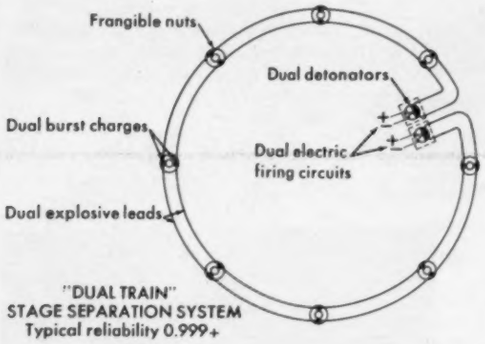
Edward W. Schrader, Western Editor

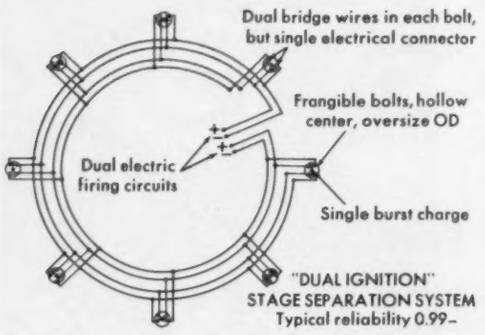
Dual train in place of dual ignition and frangible nuts in place of frangible bolts increase reliability of a missile stage separation system. In this design, the nuts part on bursting of charge instead of the bolts.

The frangible nut has stress concentration notches or grooves in two places, 180 deg apart. Either of the dual explosive leads that fire the burst charges in each nut is capable of fracturing the nut to effect disengagement and stage separation of the missile.

The frangible nut approach is particularly applicable where the separation does not involve shear between the two stages. In the particular missile application, separation is axially in line with the bolts.

The frangible nut and dual train stage separation system is a design development of Special Devices, Inc., Newhall, Calif.





DIAGRAMS depict differences between dual train and conventional dual ignition systems. Dual train system adapts naturally to "out-of-line" explosive safety. Dual ignition system is incompatible with "out-of-line" explosive safety.

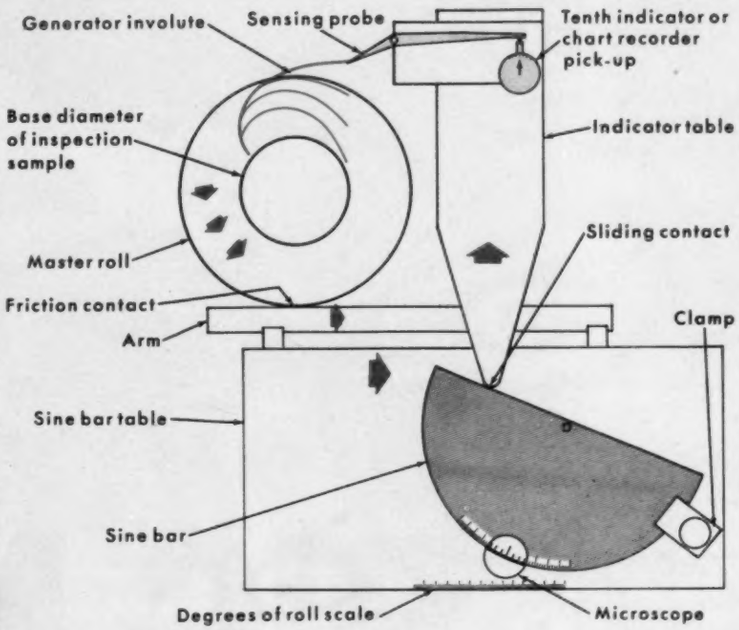
Optical Index Head Positions Sine Bar in Involute Checker

DETROIT, MICH.—An integral optical dividing head is incorporated into a line of involute profile checkers. The dividing head positions a sine bar controlling the development of the involute form. The sine bar angular setting establishes the proper ratio between the single master roll disc and the base diameter of the gear being checked. This permits the one master roll to be used to generate the involute for any smaller-diameter-part base circle.

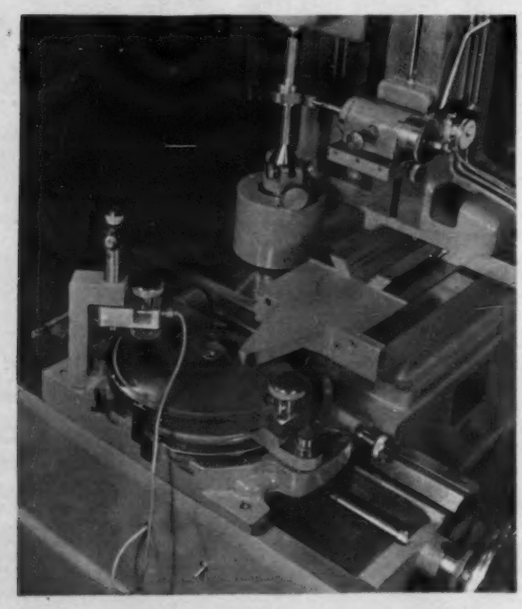
The use of the dividing head eliminates the requirement for gage blocks and removes the element of operator "feel" in setting the sine bar. The bar may be readily set to within 0.001 deg. Checking accuracy is repetitive to within 0.0001 inch. The instrument can check the profile of both spur and helical gear teeth. It also can be used with attachments to check tooth spacing. Rapid checking for consistency of form on successive teeth is possible since such checks can be made on any point of the contour. The instrument can be used on coarse and fine diametral pitch gears. Special adapters are available for finer teeth and for internal gears.

The "Sine-Line" Involute checker is a product development of the Michigan Tool Co.

E. J. S.



SINE BAR relative motion of two slide tables moving horizontally at right angles. Rotation of work spindle on master roll disc causes sine bar table to move by friction contact with attached tangential arm. Sine bar, controlling motion of indicator slide, is set at angle so that slide moves distance equal to 1/360 of part base circle circumference per degree of part rotation. Sensing probe, set opposite rotational center of part to travel in path tangent to part base circle, generates involute of part base circle as part is rotated. Variation sensed by inspection probe between profile on part and generated true involute form is read as involute error.



MASTER INVOLUTE is used in check-out of machines and is available accessory for routine check of accuracy of instrument in continuous use.

FILAR MICROSCOPE is used to set divided index plate and integral sine bar. Hand wheel and lead screw adjustment is provided to position indicator probe to suit height and diameter of part being inspected and angular setting of sine bar. Scale on sine bar table or pick-up on work spindle permits reading or recording degrees of rotation of part. Direct reading from graduated scale and dial indicator shows error in form. Accessory strip-chart recorder can provide permanent checking record.

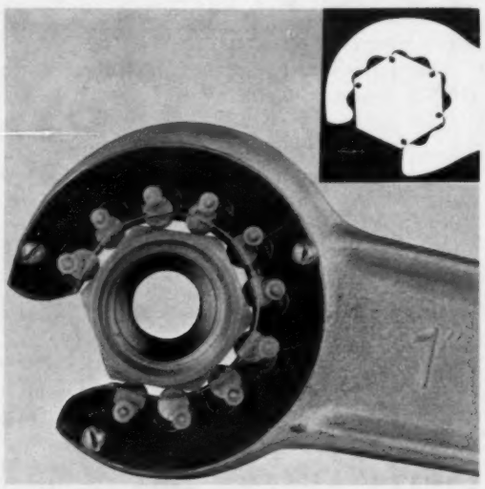
Circular Grip Wrench Eliminates Fitting Distortion

DETROIT, MICH.—A driving tool with a "circular" grip contacts the hex of a fastener or tube fitting on the flats instead of on the corners. It exerts equal torque at all points of contact and does not distort the hex or fitting.

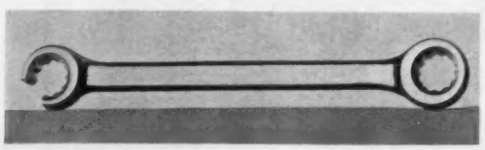
Because the distortion of a fitting extends down into the threaded portion it is noted that the torque required for any given thread engagement of the fitting is substantially lower with the circular grip tool. Leaks in tube fittings resulting from distortion or faulty torque readings are avoided.

The circular grip "Cam Loc" wrench in ratchet and solid types is manufactured by the TKF Co.

E. J. S.



ROLLER CAM ACTION is shown by wrench fitted with special transparent retaining plate. Circular grip is obtained by automatic change of radius of roller contact until all rollers bear with equal pressure at all points of contact. Automatic positioning provides sufficient adjustment to grip fitting previously distorted by other wrenches. Solid tool has simulated roller cam-type jaw form. Gripping is on flats of the hex as with roller cam tool. Positive relief at "points" prevents contact at corners.



CIRCULAR GRIP TOOLS are made in roller ratchet and solid jaw-types. Ratchet wrench has 10 roller cams in machined slots backed up with stainless-steel springs holding rollers in pull position and snapping them back during ratchet action. Rollers rotate approximately 180 deg in dimples in retaining face plates. Solid tool is made in open end and full box pattern.

IDEAS IN THE NEWS

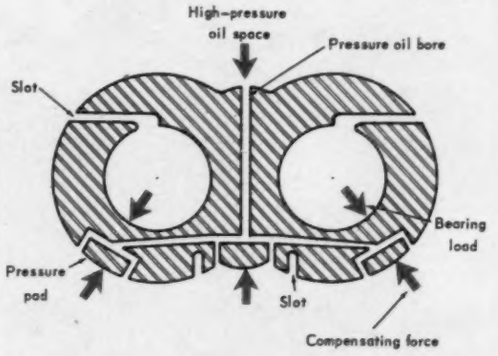
• **A NEW GEAR PUMP** uses oil pressure to exert highly concentrated radial forces on the bearings. This compensates the bearing loads and the resulting deflection. Friction losses and leakage caused by displacement of gears away from their true axes are reduced greatly.

Output oil under high pressure is directed through the bearing shells to piston-like, round bearing pads which are pushed against the housing. Pads are located so that contact forces between shell and housing oppose radial forces on the gear.

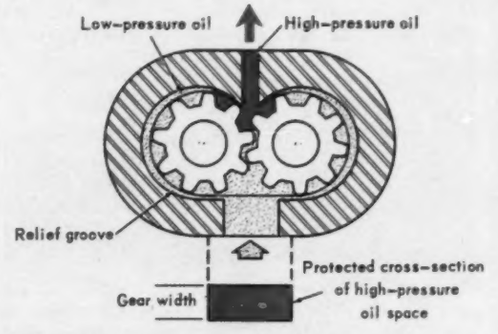
Since gears are not displaced from their ideal positions, clearance can be kept very small. Volumetric efficiency is high (98 percent at 150 atmospheres). Fewer teeth are needed to seal the high-pressure oil space from the intake side, resulting in a smaller effective cross-section of the high-pressure oil space.

The pump is a development of Robert Bosch GmbH, Stuttgart, Germany.

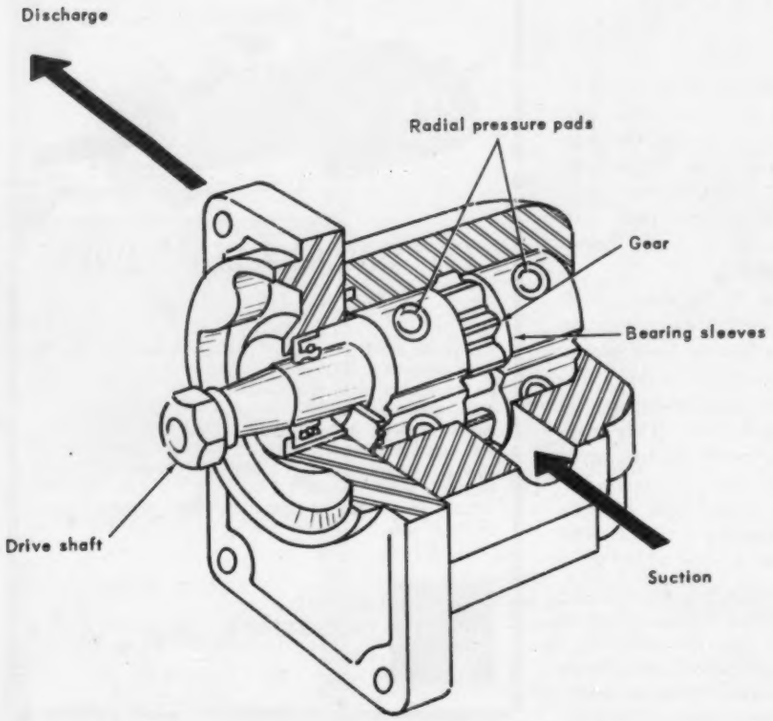
R. F. S.

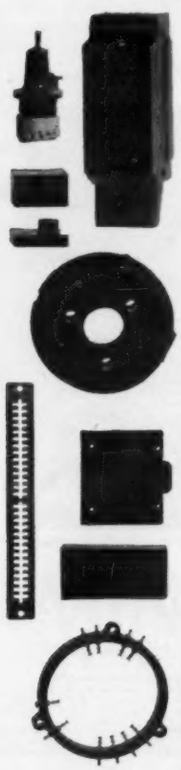


CROSS-SECTION of floating bearing shell shows pressure oil passages to three pads. Slots in bearing shell prevent distortion of bearing axes through locally acting forces.



REDUCED CLEARANCE requires fewer teeth to seal high-pressure oil space. Remaining spaces between teeth are kept at low pressure by relief groove. Total cross-section of high-pressure space and bearing load is small.





3 new flame-proofed molding compounds join Diall FS-80

The extreme flame resistance and rapid flame-out properties of durable, easy to mold Diall FS-80 have found such strong acceptance that three additional Diall compounds with these capabilities are now offered out of stock. Volume and surface electrical resistivity are retained. Each is qualified under MIL-M-14F. Your letter written today will return full details. Mesa Plastics Company, 12270 Nebraska Ave., Los Angeles 25, California

■ **FS-80**... a Diallyl Meta-Pthalate filled with ½" glass fibers, has strong structural properties, while retaining excellent moldability. Applications include switches, connectors and potting vessels

■ **FS-10**... a Diallyl Meta-Pthalate filled with short glass fibers, is supplied in granular form for convenience in both standard and automatic presses. It is recommended for high precision parts requiring strong resistivity and mechanical strength

■ **FS-60**... a Diallyl Ortho-Pthalate, asbestos filled and in granular form, for economy where high flame and heat resistance are needed but the requirement does not include mechanical strength under heavy loads or stresses

■ **50-52**... a Diallyl Ortho-Pthalate, Dacron* filled for high impact strength, is specified where plastic parts are subject to frequent abuse. Typical applications include umbilical connectors, mounting plates and protective covers.

MESA DIALL

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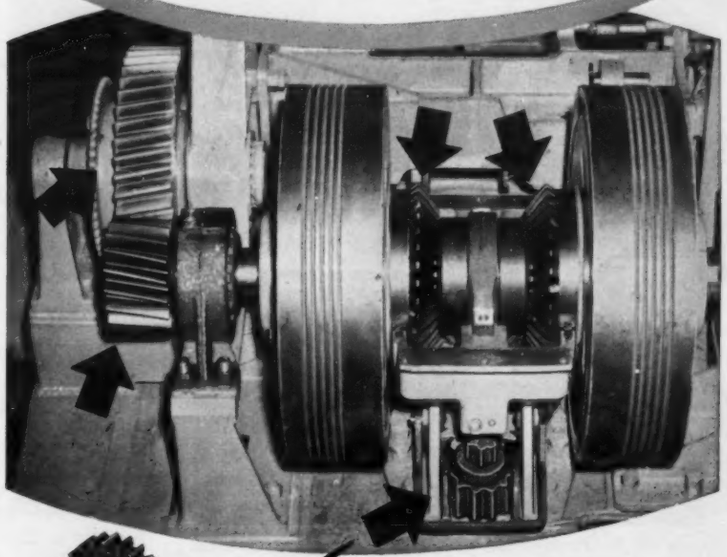
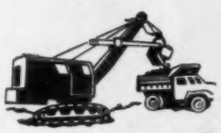
Do You have requirements for "Special Gears?"





✓ CHECK with FAIRFIELD!

"Fairfield has furnished us with bevel and spur gears for many years and we are highly satisfied with their product," states one of America's best known makers of shovels, cranes, and draglines in referring to the above picture. Each gear (*see arrows*) is precison produced to match this builder's specifications for *plus value* quality.

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IDEAS IN THE NEWS

• **MOLDED BISKETS** apply braking action to a floating disc in caliper-type hydraulic spot brakes on karts. For racing service, Johns-Manville molded friction material Type 140 is used. For conventional driving, Type 145 is used. Both materials are molded with integral brass particles. Type 140 is designed for higher temperature applications than Type 145.

The disc brake is located on the rear axle. It is engineered with an 8:1 mechanical advantage applied from either a top or bottom lever action. The hydraulically operated caliper brake works on a ground disc, which is full-floating on the live shaft with a 1/4-inch keyway. This gives positive engagement to the two opposing brake biskets.

Dynanometer tests have shown that a stock McCulloch MC-10 engine running at 5000 to 7000 rpm cranks out 12.5 lb-ft of torque. Many karts carry two of these power plants, working through an 8.4:1 gear ratio to produce 210 lb-ft torque to the rear axle.

One track test, on the 100-mile Tecate Gran Premio, showed only 0.006 inch of wear on the biskets. Following the race, the kart was run for 8 miles at high speed with the brakes dragging. At this point the 8-inch brake disc was red hot. Successive panic stops were then made to prove that there was no loss in braking efficiency. The karts are capable of 60 to 70 mph in the 100-mile race.

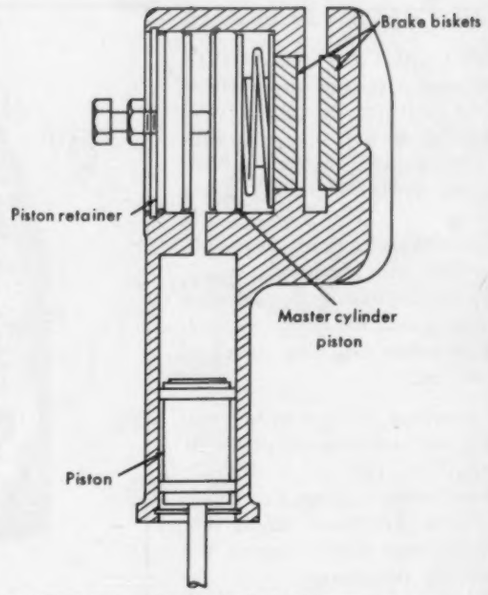
The caliper-type spot brake is a design development of Palmini Engineering Corp., South San Gabriel, Calif.

E. W. S.

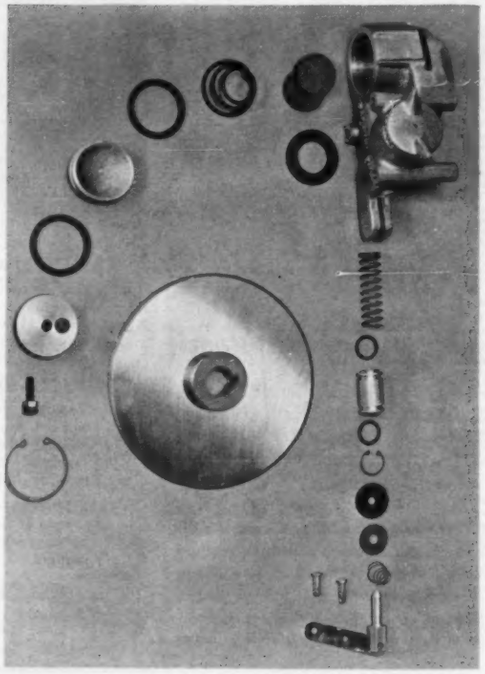

BRAKE mounted on typical kart which uses racing-type slick tire and tapered wheel hub.

Circle 50 on Reader-Service Card for more information

Circle 52 on Reader-Service Card



CALIPER-TYPE HYDRAULIC BRAKE operates on heavy-duty hydraulic brake fluid. When plunger shaft is pushed in, piston moves fluid from reservoir into main cylinder. Fluid then forces master cylinder piston and movable brake bisket out until they make contact with floating brake disc, which rotates between two brake biskets. When actuating lever is released, master cylinder spring forces master cylinder back, releasing force on brake bisket and disc. Master cylinder then returns to its original position against adjuster nut and bolt, located in piston retainer.



Circle 53 on Reader-Service Card for more information

Circle 54 on Reader-Service Card for more information

IDEAS IN THE NEWS

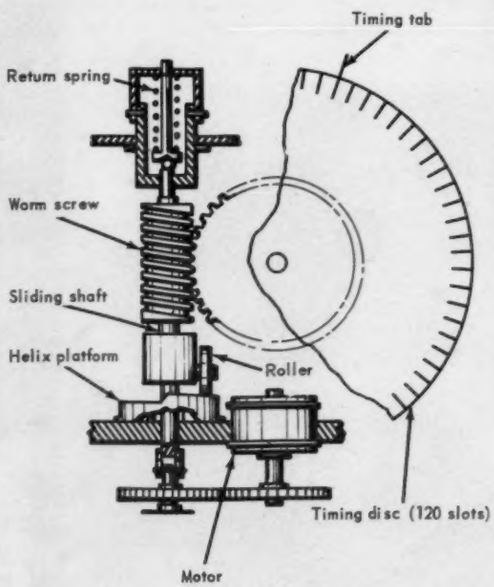
• **INTERMITTENT ACTION IMPROVES** accuracy of a precision electrical programmer by insuring positive switching at precise time intervals. A synchronous motor, operating continuously, drives a timing disc through the intermittent mechanism, so that the disc revolves 3 deg in a step.

Tabs, placed at selected positions on the periphery of the timing disc, tilt a mercury switch when passing. This occurs during the stepping movement of the disc so that the mercury switch quickly initiates a secondary switching operation and then returns to rest.

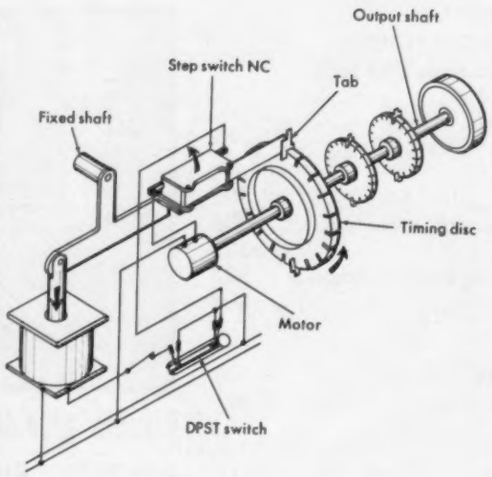
The secondary switching starts a second motor which is latched "on" until turned off by its own integral timing disc. This motor drives a shaft having 10 more timing discs, each of which operates a limit switch. The main timing disc initiates a secondary system which controls the 10 output lines of the programmer.

The main timing disc completes one revolution in periods ranging from 10 minutes to 24 hours depending upon its gearing. This interval is divided into 120 equal parts by the slots for the switching tabs on the periphery of the timing disc. The programmer was designed and is manufactured by Alkan & Sinay Co., Paris, France.

G. B. B.



INTERMITTENT ACTION is generated by continuously rotating worm gear on sliding shaft. As gear rotates, roller turns around helix platform, raising gear at same rate as thread pitch so that timing disc does not move. When roller passes over step, it drops quickly, drawing worm gear down under return spring pressure. This action steps timing disc 3 deg.



Meetings

Milwaukee, Wis. Sept. 11-14	"HEAVY-DUTY" VEHICLE MEETING AND DISPLAY, Society of Automotive Engineers, Milwaukee Auditorium.
Los Angeles, Calif. Sept. 11-15	FALL INSTRUMENT-AUTOMATION CONFERENCE AND EXHIBIT, Instrument Society of America, Memorial Sports Arena.
Detroit, Mich. Sept. 11-22	INSTITUTE IN EXPERIMENTAL STRESS ANALYSIS, Wayne State University.
Indianapolis, Ind. Sept. 12	REGIONAL TECHNICAL CONFERENCE, Society of Plastics Engineers, Severin Hotel.
Chicago, Ill. Sept. 18-20	ANNUAL MEETING, Standards Engineers Society, Hotel Sherman.
Utica, N. Y. Oct. 2-4	SEVENTH NATIONAL COMMUNICATIONS SYMPOSIUM, Institute of Radio Engineers.
Washington, D. C. Oct. 2-7	XIIIth INTERNATIONAL ASTRONAUTICAL CONGRESS, American Rocket Society.
Ann Arbor, Mich. Oct. 3-6	SEVENTH ANNUAL U. S. ARMY HUMAN FACTORS ENGINEERING CONFERENCE, Army Research Office, Office of the Chief of Research and Development, Institute of Science and Technology, University of Michigan.
Santa Catalina Island, Calif. Oct. 5-8	ANNUAL MEETING, American Society of Industrial Designers, St. Catherine Hotel.

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NEW PRODUCTS

NEW LITERATURE

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PLANS AND CROSS-SECTIONS

'Wet' Bullets Wield Wallop

Water pistols have gone from the toy shop to the research laboratory. Researchers are firing water "bullets" into metal targets at supersonic speeds to study erosive action of water droplets.

The water jets, traveling at velocities up to 3400 mph, are released when a lead pellet is fired by compressed air into a small sealed reservoir. The jet then strikes the test metal. It can leave a sizeable dent in thick slabs of copper and stainless steel.

S. M. DeCorso and R. E. Kothmann of the Westinghouse Electric Corp.'s research laboratories, Pittsburgh, Pa., said the tests are aimed at finding ways to prevent erosion in turbine blades from water drops in moist steam. Similar erosion affects airplane and missile surfaces when they hit raindrops at high speed.

A side effect of the scientific shooting expedition has yet to be explained. Photographs show that a burst of light, lasting less than one-millionth of a second, is given off by the water as it crashes into metal. No one knows why.

Made by Trained Ants?

Little things mean a lot at the Radio Corp. of America Laboratories, where development of an ultratiny transistor is seen as pointing the way to low-cost mass production of transistor circuits. The new transistors, tested successfully, are said to be so small that 20,000 of them can be placed on a postage stamp. The miniaturized transistor is made by depositing thin films by evaporation on a glass insulating base.

And this is our best seller.

Computer Relieves the Translation Headache

Fast, Fast, Fast

A test production model of an electric computer system capable of translating Russian into English at 60,000 words an hour has been demonstrated. Using computerized dictionaries, the new Unified Transfer System is many, many times faster than skilled human translators and can be adapted to translate any language into another, as long as one is an Indo-European tongue. UTS was developed by Machine Translation, Ltd., Washington, D. C.

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